INVENTORY AND CHARACTERIZATION REPORT – LOCAL ADOPTION DRAFT

FOR SHORELINES IN WAHKIAKUM COUNTY AND THE TOWN OF CATHLAMET

2017

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Contents

List of Appendices

Executive Summary

This Inventory and Characterization Report was prepared for Wahkiakum County (County) and the Town of Cathlamet (Town) under a Washington State Department of Ecology (Ecology) grant to help update the County's and the Town's Shoreline Master Program (SMP). Washington's Shoreline Management Act of 1971 and its implementing State SMP Guidelines require a comprehensive update to both SMPs. which were first adopted in 1975 and amended several times in the 1980s and '90s.. Under these Guidelines, the County and Town must base the master program provisions on current shoreline conditions as determined by an analysis of the most current, relevant and accurate scientific and technical information (WAC 173-26-201(3)(c)and(d)). This includes meeting the mandate of "no net loss of shoreline ecological functions" as well as providing mechanisms for restoration of impaired shoreline functions. The Inventory and Characterization Report is not a binding regulatory document but rather provides guidance for the shoreline planning process and potential future updates to the SMP.

The County's and Town's SMP update is a multi-year process which begins with an inventory and characterization of existing environmental and land use conditions, otherwise known as a baseline condition. As part of developing a description of thebaseline condition, this Inventory and Characterization Report contains an inventory of land use, landscape processes, and ecological functions. These elements are spatially catalogued using a Geographic Information System (GIS), where possible, and are presented as both a County- and Town-wide Map Folio. Together these elements define what is understood to be the existing, present day conditions, help inform the review of current shoreline regulations, and highlight areas where changes may be necessary to meet shoreline management goals to provide for water dependent uses, public access and the protection of natural resources.

Key information provided in this report includes: characterization of existing ecological functions through an analysis of both physical and biological processes; an analysis of existing land uses, shoreline modifications, public access, and areas under public ownership or preservation holdings; preliminary identification of existing restoration projects and opportunities; and recommendations for the SMP to help meet the updated SMP Guidelines.

A summary of the findings from the Inventory and Characterization Report includes:

- Habitat loss and degradation has occurred to important salmonid migration, rearing and spawning habitat. Much of the degradation is the result of historic forestry practices in the upper reaches. However updated Forest Practices Act has improved conditions although many logging roads with undersized culverts still exist.
- There is already active restoration in many of the subbasins that has been occurring over the last decade particularly in the Grays River, Elochoman and Skamokawa subbasins.
- Public land, primarily DNR owned forestry land, the National Wildlife Refuge, and land acquired by non-governmental organizations such as the Columbia Land Trust present opportunities for both restoration and protection
- The County and Town are not projected to grow rapidly over the next 20 years. However, areas that have seen, and will likely continue to see, the most land use changes (i.e. less intensive agriculture to smaller residential lots) and increases in development are the Elochoman Valley and Puget Island.

- Several public access points (i.e. parks) have been improved (i.e. Oneida Park). Opportunities to increase and improve public access, in both the Town and County are abundant.
- Some areas of potential challenges and opportunities include areas in Lower Deep River, Grays River, and Skamokawa Creek have a number of derelict docks, piers, overwater structures and/or vessels. Opportunities to address these issues include incentives, develop shared docks, DNR's derelict vessel program, and others.
- A review of the shoreline variances and other permits indicates an opportunity to develop an updated SMP for both the Town and County that focuses on addressing common shoreline development in a way that permits their use without needing to go through a conditional use or variance process. This would streamline the application and approval process for landowners and developers under the updated SMP.

Chapter 1: Introduction

1.1 Background and Purpose

Wahkiakum County and the Town of Cathlamet are updating their Shoreline Master Program (SMP) as a combined, regional effort. According to Substitute Senate Bill (SSB) 6012, passed by the 2003 Washington State Legislature, cities and counties are required to amend their local SMPs consistent with the Shoreline Management Act (SMA), Revised Code of Washington (RCW) 90.58, and it's implementing guidelines, Washington Administrative Code (WAC) 173-26. Both the County and the Town are required to complete the SMP amendment process by June 2016. Funding for the SMP update has been provided by the Washington State Department of Ecology (Ecology) through an SMA grant (Agreement No. G1400483). The state grant funds are provided by Washington State Biennia's General Fund for Shoreline Implementation, §302; and the Local Toxics Control Account, §302, Subsection 7. As per the requirements of the grant, the Wahkiakum – Cathlamet effort is scheduled to complete a locally adopted SMP by June 30, 2016. The 2016 due date established by the grant replaces the previously established statutory due date of December 1, 2014.

Wahkiakum County and Town of Cathlamet are jointly conducting the comprehensive SMP update in 2 phases over the next few years. The first phase is the development of an inventory and characterization of the shorelines. In the second phase, the County and Town will update their shoreline management policies and regulations. The county-town collaboration is formalized in an interlocal agreement, and is prescribed by the terms of the County's funding agreement with Department of Ecology. The intent is that both the Town and the County will each adopt the same regional SMP.

The characterization report documents baseline shoreline conditions and provides a basis for revising SMP goals, policies, and regulations for the County and Town. This characterization will help to evaluate existing functions and values of shoreline resources, and explore opportunities for conservation and restoration of ecological functions. This study also characterizes ecosystem-wide processes and how these processes relate to shoreline functions. Processes and functions are evaluated at 2 different scales: (1) a watershed or landscape scale, and (2) a shoreline reach scale.

The purpose of the watershed or landscape scale characterization is to identify ecosystem processes that shape shoreline conditions and to determine which processes have been altered or impaired. The intent of the shoreline reach scale inventory and characterization is to: (1) identify how existing conditions in or near the shoreline have responded to process alterations; and determine the effects of the alteration on shoreline ecological functions. The findings will help provide a framework for future updates to the shoreline management policies and regulations.

Characterization and analysis was prepared by the Columbia River Estuary Study Taskforce (CREST) in collaboration with Wahkiakum County and Town of Cathlamet planning staff along with review and comment by the Shoreline Advisory Committee (SAC) and the Technical Advisory Committee (TAC).

1.2 Report Organization

The information in this report is divided into nine Chapters. Chapter one , the Introduction, discusses the purpose of this report and describes the regulatory context for shoreline planning.

Chapter two describes the methods, approach, and primary data sources used for this inventory and characterization. Chapter three provides a profile of the ecosystems within the County. This ecosystem profile discusses regional overview, process controls (e.g., climate, geology), fish and wildlife, and key ecosystem-wide processes and landscape analysis results. Appendix D includes the methods involved in performing the ecosystem-wide process analysis.

Chapters four and five provide the shoreline inventory of freshwater shoreline rivers organized into categories by HUC 10 watersheds as they occur within the Water Resource Inventory Area (WRIA) in Wahkiakum County. The entire state is divided into WRIAs designated by Washington Department of Ecology as administrative units for watershed planning. In Wahkiakum County, WRIA 24 (Willapa) consists of a part of the Naselle River – Frontal Willapa Bay HUC 10 watershed. WRIA 25 (Grays-Elochoman) encompasses most of the County and consists of the Wallacut River – Frontal Columbia River, Grays Bay, Baker Bay – Columbia River, Elochoman River – Frontal Columbia, Cathlamet Channel – Columbia River and Germany Creek – Columbia River HUC 10 watersheds (see Appendix E Map 6). Chapters 4 through 8 provide analysis and characterization for each HUC 10 watershed.

Chapters four and five provide physical and biological characterizations of conditions in the vicinity of the shoreline regulatory zones of the County organized by WRIA and HUC 10 watershed. The chapters also provide assessments of shoreline use patterns, describe the built environment, and identify potential opportunity areas for protection, enhancement, restoration and public access.

Chapter six is an analysis and discussion of existing trends and future demand of uses within the shoreline area and potential land use conflicts. Chapter seven is the shoreline analysis summary with recommendations. Chapter eight provides the reference list for this document.

There are six appendices (listed in the Table of Contents above). Appendix A is the shoreline reach-scale inventory matrix that identifies the reaches and subsequent physical, biological and land use elements in each particular reach. APPENDIX B is the GIS data sources used for the completion of the Map folio and analysis for this report. APPENDIX C is the list of Acronyms used throughout the document. APPENDIX D is a detailed discussion regarding the methods used to identify Ecosystem-wide processes (Important and Impaired areas). APPENDIX E is a map folio that illustrates the shoreline planning areas within Wahkiakum County and documents various biological, land uses, and physical elements at the watershed analysis scale. APPENDIX F is a list of species potentially found in Wahkiakum County.

1.3 Regulatory Overview

Washington's Shoreline Management Act (SMA) was passed by the State Legislature in 1971 and adopted by the public in a referendum. The goal of the SMA is "to prevent the inherent harm in an uncoordinated and piecemeal development of the state's shorelines." While protecting shoreline resources by regulating development, the SMA is also intended to provide for appropriate shoreline use. The SMA encourages public access and recreational use of public shorelines and the allowance of water dependent uses, giving top preference to uses that protect, enhance and conserve shoreline functions and values.

The primary responsibility for administering the SMA is assigned to local governments through the mechanism of local shoreline master programs, adopted under guidelines established by Ecology.

The guidelines (WAC 173-26) establish goals and policies that provide a framework for development standards and use regulations in the shoreline. The SMP is based on state guidelines but tailored to the specific conditions and needs of individual communities. The SMP is also meant to be a comprehensive vision of how the County's shoreline area will be managed over time.

1.4 Shoreline Jurisdiction and Study Area Boundary (Appendix E Maps 1 & 2)

SMA jurisdiction includes all *shorelines of the state* as defined in RCW 90.58.030. Shorelines of the state include the total of all *shorelines* and *shorelines of statewide significance*. "Shorelines" means all of the water areas of the state, including reservoirs, and their associated *shorelands*, together with the lands underlying them, *except*:

- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments; and
- Shorelines on lakes less than 20 acres in size and the wetlands associated with such small lakes.

"Shorelines of statewide significance" include rivers that have a mean annual flow of 1,000 cubic feet per second (cfs) or greater, freshwater lakes with a surface area of 1,000 acres or more, and portions of certain marine waters (RCW 90.58.030).

The shoreline jurisdictional area regulated under the Town of Cathlamet and Wahkiakum County SMP must include all shorelines of statewide significance, shorelines, and their adjacent "shorelands," defined as the upland area within a minimum of 200 feet from the Original High Water Mark (OHWM), as well as any "associated wetlands" (RCW 90.58.030). See Figure 1.1 and 1.2. "Associated wetlands" means those wetlands that are in proximity to and either influence or are influenced by tidal waters or a lake or stream subject to the SMA (WAC 173-22-030 (1)). These are wetlands that physically extend into the shoreline jurisdiction, or wetlands that are functionally related to the shoreline jurisdiction through surface water connection and/or other factors.

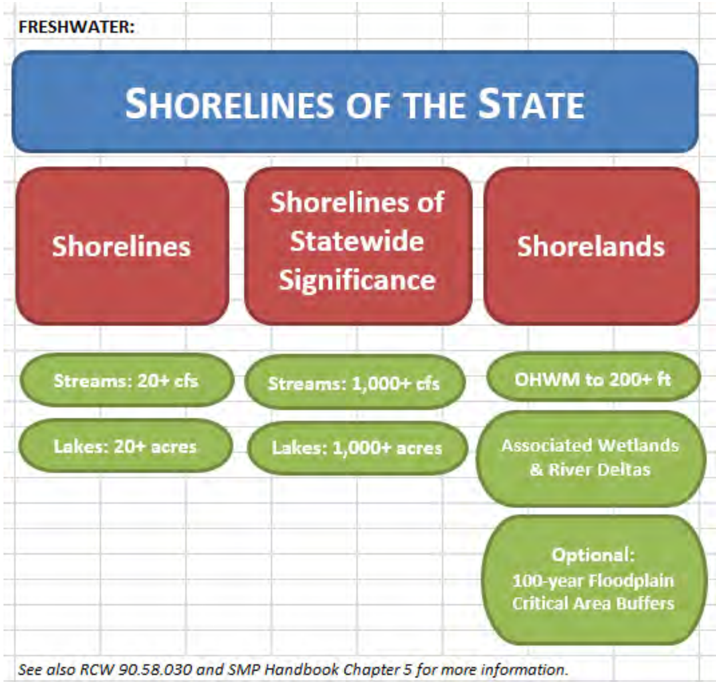


Figure 1.1 Shorelines unde

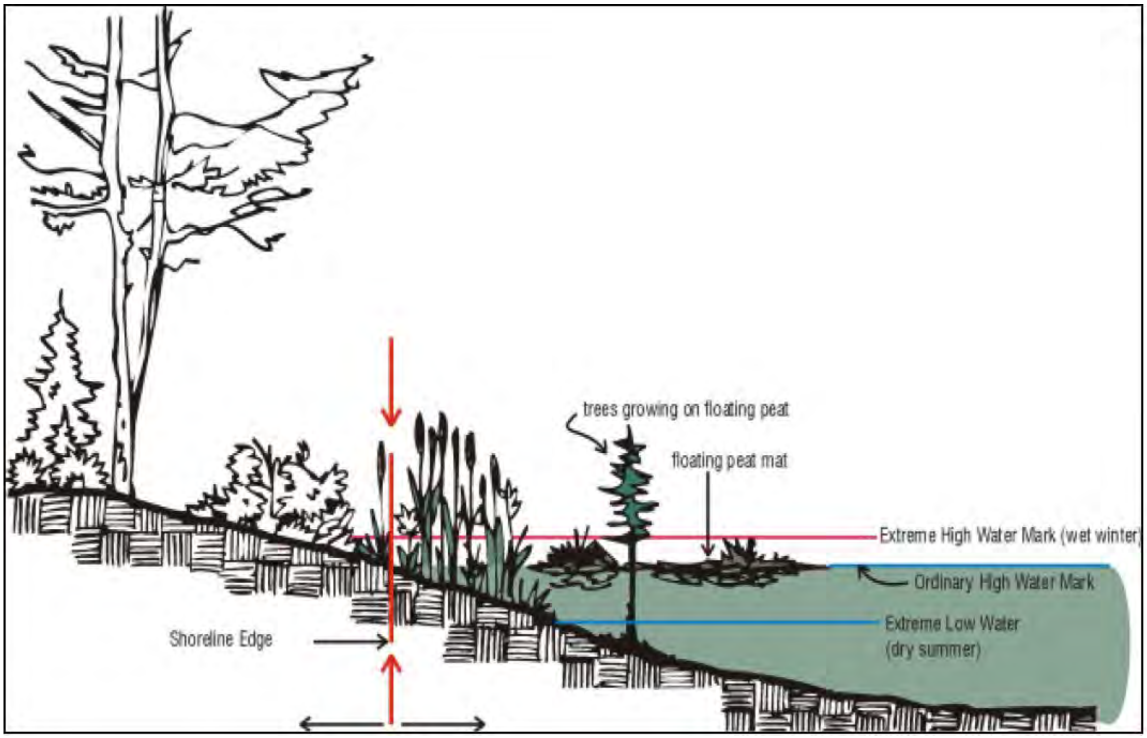


Figure 1.2 Location of the Ordinary High Water Mark (OHWM). Source: Ecology Handbook 2003

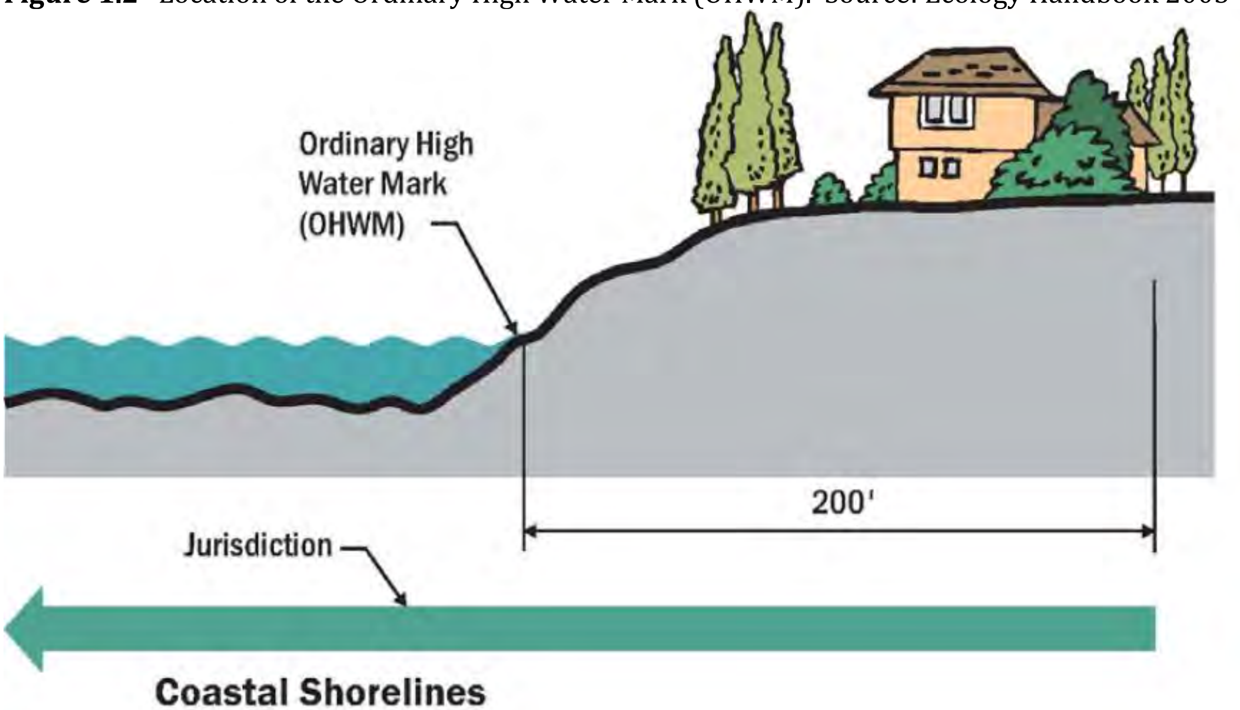


Figure 1.3 Shoreline jurisdiction extending 200 ft. landward from the OHWM

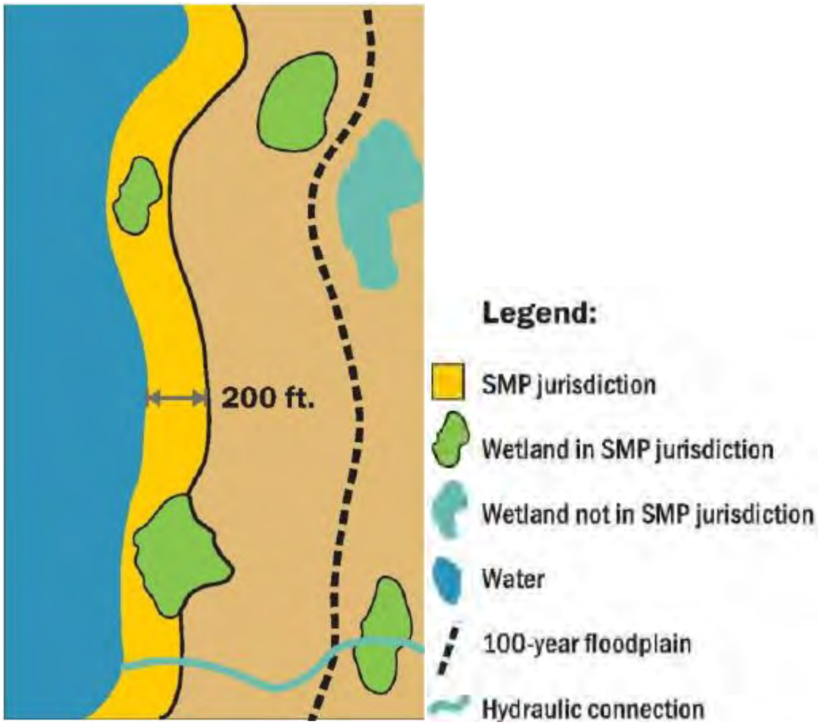


Figure 1.4 Wetlands in shoreline jurisdiction are either fully or partially within 200 feet of the OHWM, within the floodplain or associated through hydraulic continuity

Local jurisdictions can choose to regulate development under their SMPs for all areas within the 100-year floodplain or a smaller area as defined above (RCW 90.58.030(f)(i)). This includes buffers for critical areas (see Figure 1.5). For the purposes of this report, the entire 100-year floodplain is included in the study area or herein referred to as the shoreline planning area. Numerous streams in Wahkiakum County are regulated as “shorelines of the state” under the SMA. Shorelines of statewide significance include the Columbia River (greater than 1,000 cfs).

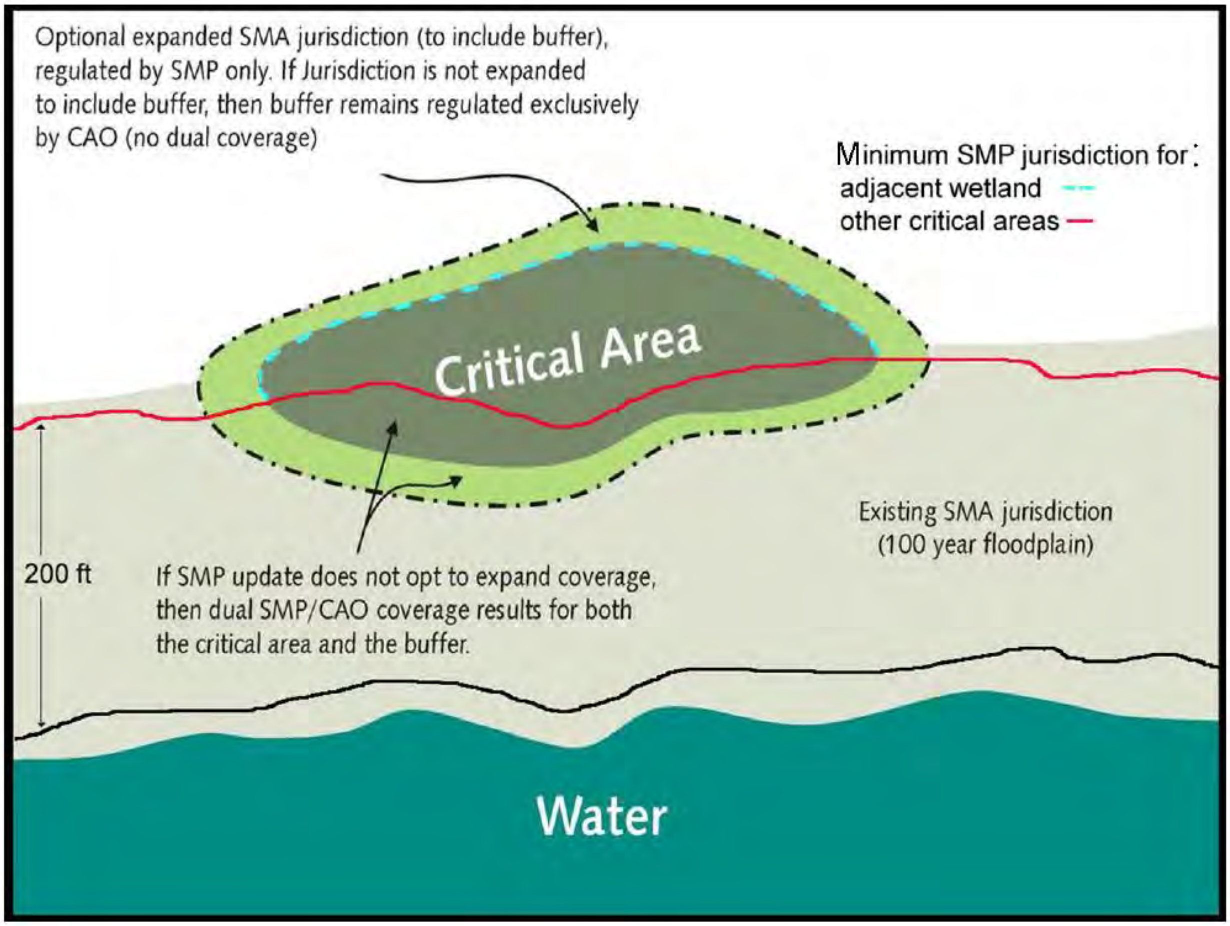


Figure 1.5 Local governments have the option to expand SMA jurisdiction to include lands necessary for buffers for critical areas.

RCW 35.21.160 authorizes the Town jurisdiction extends out to the mid-Columbia County/State line. However, because of Puget Island's location immediately opposite the Town, local interpretation of this provision currently extends the Town's shoreline jurisdictional area to mid-line of the Elochoman Slough/Cathlamet Channel between the mainland and Hunting Islands/Puget Island.

1.5 Existing Plans, Programs, and Regulations

1.5.1 Jurisdictions

Wahkiakum County and the Town of Cathlamet are the only two local jurisdictions with shoreline permit review authority within the County. Both the County and the Town of Cathlamet regulate their respective shorelines under separate existing Shoreline Management Programs. The County has several unincorporated towns located within its boundaries, including Deep River, Grays River, Rosburg, andSkamokawa. Community planning and permitting for the unincorporated communities in the County fall within county jurisdiction.

1.5.2 Wahkiakum County Shoreline Master Program

Wahkiakum County adopted its first Shoreline Master Program on August 12, 1975 and has made several amendments between the 1980's and 1990's that involved collaboration with the Town of Cathlamet. The existing SMP for Wahkiakum County, in its current form, is not up-to-date with the new SMA regulations and guidelines (SMA guidelines updated in 2003). The Wahkiakum - Cathlamet SMP update will align the County's and Town's SMP with the current SMA standards and requirements. The current County SMP regulations are codified in the Revised Code of Wahkiakum County (RCWC) Title 43, along with regulations for Critical Areas and SEPA implementation.

1.5.3 Town of Cathlamet Shoreline Master Program

The Town of Cathlamet adopted Wahkiakum County's first shoreline master program, which was officially approved by Ecology June 17, 1975. Since the adoption of their first master program, the Town of Cathlamet has not adopted any additional amendments to the original plan. The Town's SMP in its current form, is not up-to-date with current SMA regulations and guidelines. The joint Wahkiakum County and Town of Cathlamet SMP update process will align the Town's SMP with current SMA guidelines and regulations. The Town of Cathlamet currently contracts with Wahkiakum County to administer their SMP and shoreline permit review process.

1.5.4 Comprehensive Plans

The Wahkiakum County Comprehensive Plan, adopted in 1996 and amended in 2005, contains goals and policies to guide land use decisions and the management of critical areas (Wahkiakum County, 2005). The County completed a draft comprehensive plan update in 2008, but a final version of the plan has yet to be adopted by the County.

The Town of Cathlamet Comprehensive Plan was adopted in 2002 as Ordinance 430 and is codified as Title 19 of the Cathlamet Municipal Code (CMC).The Town's 'Comp Plan' similarly provides a broad community vision and policy guidance for land use and development in the Town's commercial, industrial, and residential areas.

1.5.5 Zoning

Wahkiakum County has not established land use zoning districts and does not have a zoning map or zoning regulations. The County regulates growth and development under the Wahkiakum County Code with requirements for building, health & safety, environmental protection, and other provisions.

The Town of Cathlamet Zoning Ordinance (1995) established land use districts under CMC Title 18 to determine allowed uses and related development standards. The Town's zoning map is included in the CMC Title 19 Comp Plan (see Appendix E Map 55.)

1.5.6 Critical Areas Regulations

Wahkiakum County regulates activities in or adjacent to environmentally sensitive areas under its Critical Areas Ordinance (CAO), adopted in 2000 (RCWC Chapter 43.70). The Town of Cathlamet has adopted a Critical Areas Ordinance in 2002 (CMC Title 14.15) for similar purposes.

Critical areas protected by both the County's and Town's CAOs include wetlands, critical aquifer recharge areas, frequently flooded areas, landslide hazard areas, seismic hazard areas, erosion hazard areas, and fish and wildlife habitat conservation areas. The County's CAO also establishes protections for long term commercial forest lands, agricultural resource lands, in-holding lands, and agriculture and forest management non-designated lands. This Inventory and Characterization Report addresses Critical Areas within each watershed section in Chapters 4 and 5 to discuss the important structural and functional role these areas play in each watershed and how development and land use currently interact with these critical areas.

Once the Wahkiakum – Cathlamet Regional SMP is updated, all critical areas located within shoreline jurisdiction for both the Town and County will be managed solely under the updated SMP. Environmentally sensitive areas located outside shoreline jurisdiction will continue to be regulated by the Town's and County's CAOs respectively. Additionally, under separate state authority (non-SMA), both the Town and County are due to update their CAOs to meet current standards that reflect the best available science.

One example of the CAOs current deficiency includes riparian habitat buffers intended to protect sensitive fish and wildlife habitat along streams, rivers, sloughs, and bays. WDFW management recommendations call for riparian buffers based on recommendations from technical work by K. Kuntson and V. Naef (1997). Current Town and County CAO buffer standards are smaller in some casesthan the WDFW recommendations which rely on more recent best available science.

1.5.7 Flood Plain Management Regulations

Wahkiakum County's Flood Damage Prevention ordinance (RCWC Title 86.16) implements comprehensive flood damage reduction measures that are necessary for public health, safety and welfare and that allow property owners to protect their property from flood damage (Ordinance No. 109-89 and 142-06). The ordinance includes minimum requirements of the National Flood Insurance Program regulation. The ordinance includes restricting or prohibiting certain uses, requiring that uses vulnerable to floods be protected from flood damage at the time of construction, controlling the alteration of natural floodplains, controlling construction activities that may increase flood damage, and preventing or regulating the construction of flood barriers.

In addition to the floodplain management regulations, Wahkiakum County has a Comprehensive Flood Plain Management Plan. The Plan includes a study of flood hazard conditions and non-regulatory action recommendations to mitigate flood risk before flooding happens.

The Town of Cathlamet also has a 1996 Flood Damage Prevention ordinance (CMC 14.10)regulating development in special flood hazard areas, that references flood insurance rate maps and that includes language typically found in FEMA approved floodplain management ordinances.
The Wahkiakum – Cathlamet Regional SMP must address flood related issues to meet SMA standards and be compatible with local and federal flood management requirements.

1.5.8 Subdivisions

Wahkiakum County has a Subdivision Control ordinance (RCWC Title 58) to regulate the platting and subdivision of land into blocks, lots, tracts, and parcels. The Town of Cathlamet's Urban Subdivision Code (CMC Title 17) similarly regulates subdivisions.

The Regional SMP will address shoreline land division standards as needed to meet SMA requirements and reflect current local requirements as appropriate.

1.5.9 Water and Sewer Systems

Wahkiakum County has On-Site Sewage Systems and Sanitary Sewer ordinances (RCWC 70.06 and 70.15 respectively) to manage water-carried, sewage sludge, septage, and biosolid human or domestic waste. The Town of Cathlamet's Public Utilities Chapter (CMC Title 13) regulates the use, development, and financing of the Town's water and sewer systems.

The Regional SMP will address shoreline utility use and development to meet state requirements and integrate existing local standards as appropriate.

1.5.10 Transportation and Parks

Wahkiakum County's Roads & Bridges ordinance (RCWC 36) and Parks ordinance (RCWC 53) regulate County streets, roads, the Ferry, and public parks for vehicular circulation and public recreational use. The Town of Cathlamet's Streets, Sidewalks, and Public Places ordinance (CMC Title 12) regulates the use of transportation systems and parks, including use of the Town Dock.

The Wahkiakum-Cathlamet Regional SMP will address shoreline transportation, recreation, and public access provisions to meet SMA requirements and provide consistency with local standards where appropriate.

1.5.11 Vegetation and Weed Control

Wahkiakum County's Weed Control ordinance (RCWC 17 and RCWC 92) establishes the Noxious Weed Control Board, Districts, landowner responsibilities, and violation penalties to prevent the spread of non-native invasive plants. The County's Roadside Vegetation Management Policy (RCWC 92) regulates the biological, chemical, and mechanical control of roadside weeds and vegetation

Weeds and vegetation are regulated in the Town of Cathlamet under the Title 8 Health and Safety Code (CMC 8.20).

The Regional SMP must address vegetation management to meet SMA requirements and ensure consistency with local provisions when appropriate.

1.5.12 Aquatic Land Ownership

State of Washington owns, and the Washington State Department of Natural Resources (DNR) manages the beds (State-owned aquatic lands or SOALs) of all navigable waters within the county including along the Cathlamet waterfront. Any proposed use of aquatic lands must be approved in advance by the DNR. Long-term ecosystem and economic viability are among DNR's considerations regarding use of state-owned aquatic lands. DNR's primary role is that of proprietor and trustee rather than regulator. Aquatic lands statutes (RCW 79.100 through 79.145) direct DNR to manage aquatic lands to achieve a balance of public benefits including public access, navigation, commerce, environmental protection, renewable resource use, and revenue generation when consistent with other mandates. Water-dependent uses are priority uses for state-owned aquatic lands (RCW 79.105.210). Ultimately, the SMA and local SMPs are one of the primary planning tools used by DNR to guide authorized uses of state-owned aquatic lands.

1.5.13 Overlapping Federal and State Regulatory Authority

The Federal government has additional regulatory authority over shorelines and waterbodies within SMA jurisdiction. The Clean Water Act (CWA) is regulated under authority of the Army Corps of Engineers (Corps) (Section 404), State Department of Ecology (Section 401) and some authority, particularly Section 503 impaired waterbodies, are given to the State Department of Environmental Quality. Shoreline use and development within SMA jurisdiction may require project review to ensure that discharge of dredge of fill material into the water and other Federal and State water quality requirements are met.

The Endangered Species Act (ESA) is under the authority of both the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Fish and Wildlife Service (USFWS). Projects involving Federal property or a Federal Action along the shorelines may result in NOAA or USFWS (depending on the species) review of a proposed project to ensure that Federally listed endangered and/or Threatened species will not be impacted by the project.

Under the Authority of the Corps, the Rivers & Harbors Act of 1899, the Corps may review development and/or use projects to ensure that the proposed activities do not obstruct or alter navigable waters to the United States.

Proposed projects within SMA jurisdiction may also be required to obtain Hydraulic Project Approval (HPA) through WDFW. WDFW administers the HPA program under the State Hydraulic Code which was specifically designed to ensure that projects meet state conservation standards to protect fish life.

Chapter 2: Methods and Data Inventory

2.1 Data sources

The Ecology 2003 shoreline master program (SMP) guidelines state that shoreline inventory and characterizations that support local SMP amendments should be based on the most current, accurate and complete technical information. Inventories should use existing sources of information that are both relevant and reasonably available (WAC 173-26-201(c)). Aside from reconnaissance-level field visits, no new field-based data collection efforts were performed to develop the summaries and characterization included in this document.

This report incorporates and builds on past work Wahkiakum County and the Town of Cathlamet have undertaken relevant to their SMP. Key sources of information include County and Town planning documents and technical studies (including comprehensive plans and basin plans) and watershed planning documents for Water Resource Inventory Areas (WRIA) 24 and 25. GIS data and studies from state agencies (including Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (Ecology) and Washington Department of Natural Resources (WDNR)) were also used. To analyze spatial patterns and visually display data, numerous cartographic resources were consulted and used in ArcGIS (ArcMap 10.2). The Geographic Information System (GIS) map folio prepared for this SMP update is provided in APPENDIX E. In addition, a complete list of GIS/mapping data sources is included in APPENDIX B.

2.2 Establishing Shoreline Planning Area

Wahkiakum County contains approximately 203 linear miles of SMP streams (according to GIS data analysis). The Town of Cathlamet contains approximately 3 linear miles of SMP streams. The total number of miles of potential shoreline jurisdiction within the County and in the Town is based upon centerline distance for rivers and streams (does not count each river bank separately).

Except as it pertains to characterizing ecosystem-wide processes at the watershed scale, this inventory and characterization does not directly address water bodies outside the County boundary. Therefore some sections of the Columbia River, Grays River, Hull Creek, Mill Creek, East Fork Elochoman River, Naselle Creek and Salmon Creek are not covered in this report. As described later, the ecosystem analysis evaluates broad watershed areas larger than the limited shoreline jurisdictional area because of the 'downstream' influence these areas have on the County's and Town's shorelines of the state.

2.2.1 Potential Shorelines Not Designated by WAC 173-18 or 173-20

Following the passage of the Shoreline Management Act (SMA) in 1971, Ecology developed a list of all known streams and lakes considered to meet the criteria for shorelines of the state at the time. The lists, which were codified in WAC 173-18 and 173-20, have not been updated since their initial development. Streams previously identified as "shorelines of the state" in Wahkiakum County, including the Town of Cathlamet, are listed in WAC 173-18-390. WAC 173-18-720 and -730 did not identify any lakes in the county qualified as shorelines or shorelines of statewide significance when the lists were developed. This inventory and update will serve to revise the list of shoreline streams and lakes and incorporate new and current data thereby replacing the original WAC lists.

Ecology revised the list of shoreline streams in 2012 using newer data from several regional flow studies conducted by the U.S. Geological Survey (Kresch, 1998). The results of the USGS report and flow models showed that numerous streams not previously designated as "shorelines of the state" currently meet the 20 cubic feet per second (cfs) mean annual flow criterion and should be regulated as state shorelines when the SMP is updated. In other cases, the USGS study relocated the upstream boundary of the 20 cfs point further upstream or downstream from its original WAC-designated location. The streams and rivers addressed in this inventory and characterization include all those identified by the USGS study and by Ecology, which are located outside federal or Tribal lands. This inventory effort confirmed that Wahkiakum County and the Town of Cathlamet do not contain any lakes that meet the requirements for shoreline designation.

2.2.2 Lateral Extent of Shoreline Planning Area

The approximate extent of the shoreline jurisdiction within Wahkiakum County and the Town of Cathlamet is shown in the two Preliminary Shoreline Jurisdiction maps in Appendix E and referred to throughout this report as the "shoreline planning area." In general, the shoreline planning area includes:

- The regulated waterbody;
- A minimum of 200 feet of adjacent "shorelands" extending landward from the mapped edge of the approximate Ordinary High Water Mark (OHWM);
- Any bordering, neighboring, or contiguous mapped wetlands associate with the regulated waterbody;
- Optional: An area having one percent chance of flooding in any given year (also referred to as the 100-year floodplain); and
- Optional: Any buffers required for the protection of critical areas located within the shoreline area.

The shoreline extent shown in the Mapfolio should be considered useful for planning purposes only because the mapping resolution is based on relatively coarse-scale data. Site-specific delineation of wetlands, floodplains, OHWM or other key features will be necessary to determine the actual extent of regulated shoreline areas at the time of a proposed project. It is likely that wetlands are present in some portions of the shoreline planning area but have not yet been mapped. As described in Chapter one (Section 1.4, Shoreline Jurisdiction and Study Area Boundary) local governments can choose to regulate the entire floodplain under its SMP, or a smaller area. For this study, the entire mapped floodplain was included as it represents the maximum potential shoreline jurisdiction. During the SMP update process the County decided to include wetland critical areas, Fish and Wildlife Habitat critical areas, and Geological Hazard critical areas (except channel migration zones) and their buffers, that are partially included in and extend beyond the standard 200 foot jurisdictional boundary. The Town of Cathlamet decided to use the minimum jurisdiction.

2.2.3 General Location of Channel Migration Areas

Identifying Channel Migration Zones (CMZs) was done to help predict areas at risk for future channel erosion due to fluvial processes. CMZ delineations help reduce hazards to communities to guiding development and limit degradation and loss of critical habitat by ensuring that fluvial processes are accounted for. The CMZs in this report were determined through a planning level channel migration assessment (PL-CMA) using Ecology's published method (Olson et al. 2014). The PL-CMA is an abbreviated approach that relies on visible landforms, channel characteristics, and valley characteristics to identify the general location of CMZ boundaries. Channel migration rates were not analyzed providing a more conservative result than a more lengthy and costly detailed analysis.

In many locations, the CMZ boundary is mapped above the valley bottom onto the valley walls. Including the valley wall is often required to encompass areas where slope stability may be an issue if/when the channel migrates into and undermines the valley wall. For all streams except the Columbia River, the 'natural' CMZ was mapped meaning man-made structures - such as levees and roads that may limit channel migration - where not accounted for. Further, sections of channel where active channel migration was noted are depicted on the maps as points. The intensity (or rate) of migration is not represented in any way, but the point data provides a quick county-wide sense of which shoreline streams are actively migrating where risks may be greatest. (Olson, Legg, Abbe, Reinhart, and Radloff, 2014).

2.3 Approach to Characterizing Ecosystem-wide Processes and Shoreline Functions

For purposes of this report, ecosystem-wide processes were evaluated and are described at the broad watershed scale according to WRIA boundaries and HUC 10 watershed areas. In this document, the term ecosystem-wide processes refer to the dynamic physical and chemical interactions that form and maintain the landscape at the geographic scales of watersheds to basins (hundreds to thousands of square miles). These processes include the movement of water, sediment, nutrients, pathogens, toxins and wood as they enter into, pass through and eventually leave the watershed.

2.3.1 Ecosystem-wide Process Analysis and Characterization Methods

In the SMP update process, local jurisdictions are required by SMA guidelines to identify and assess key ecosystem-wide processes that create, maintain, or affect the ecological functions of local County and Town shorelines of the state. For the purposes of this report, ecosystem-wide processes were assessed at the HUC 10 watershed scale according to Water Resource Inventory Areas (WRIAs) boundaries. In this report ecosystem-wide processes and watershed processes mean the same thing and the terms are used interchangeably.

The characterization of ecosystem-wide processes present in Wahkiakum County described in the following chapters is based in part on an adaptation of the document *Protecting Aquatic Ecosystems by Understanding Watershed Processes: A Guide for Planners.* By Stephen Stanley, Jenny Brown, Susan Grigsby, and Tom Hruby (2008) (Ecology publication #05-06-027). The authors of this report used this methodology to map and describe process "important areas" and "areas of alteration" for water, sediment, water quality, and wood movement (See APPENDIX D for methodology details and resulting suitability maps). A suitability analysis was also performed by summing "Important Areas" and "Impaired Areas" separately. Values for each dataset (identified in APPENDIX D) were based on its importance to ecosystem processes (largely on how many times a particular dataset was utilized to represent a process or impairment. The result was two maps that identified both "Priority Areas" and "Impaired Areas". The use of a suitability analysis is an initial step in evaluating ecosystem-wide process important areas and processes that alter or impair those important areas. The identification of restoration opportunities is initially identified through the use of the suitability analysis (where impaired areas overlap with important areas) as well as past reports and analyses if they are available. Further analysis is needed to better identify restoration opportunities and their feasibility.

To identify management recommendations for ecosystem-wide processes, the authors used a variety of existing reports, planning documents and technical assessments. Additionally, relevant management recommendation information was pulled from Puget Sound Characterization Volume 1: The Water Resource Assessments (Water Flow and Water Quality) (Stanley, et al. 2012. Ecology Publication #11-06-016) as it was deemed applicable in Wahkiakum County.

The analysis uses Geographic Information Systems (GIS) data to examine specific ecological processes including movement of water, sediment, nutrients, pathogens, toxins, and wood as they enter, pass through, and leave the watershed (Stanley et al, 2005). These processes are largely influenced by precipitation, geology, topography, soils, land cover, and land uses. This includes major vegetation types and predominant land use – collectively called process controls. These processes form and maintain the landscape over large scales and interact with landscape features that make up the structure and function of aquatic resources (Ecology 2008). Ecosystem-wide processes determine both the type and level of performance of shoreline functions.

The purpose of the analysis is to describe the relationship between key upland processes occurring at the watershed scale and the riparian and in-water aquatic resource functions occurring at the smaller reach scale in order to 'characterize' or describe the effects of land use on key shoreline ecological functions. This analysis 1) identifies and maps areas on the landscape important to processes that sustain shoreline resources 2) determines those processes' degree of change and 3) identifies the potential for protecting or restoring impaired or degraded areas.

Shoreline ecological functions include the service performed by physical, chemical, and biological processes that occur at the shoreline where land and water meet. Shoreline ecological functions may be generally grouped into categories that affect water quality, water quantity and habitat functions. The steps below describe the analysis approach to characterizing watershed-scale processes.

Step 1 Identify Aquatic Resources and Their Contributing Areas
Aquatic resources such as rivers, estuaries and wetlands were identified and mapped within the shoreline jurisdiction and within the contributing area(s) (WRIAs and HUC 10 watersheds) as a whole.

Step 2 – Map Process "Important Areas"
Processes occurring at the landscape/watershed scale support and maintain aquatic resources to varying degrees. This analysis focuses on key processes that are fundamental to the integrity of the ecosystem and can be managed within the context of land use plans and regulations:

- Hydrology
- Sediment
- Water quality
- Wood debris

This analysis identifies and maps the relative areas important to maintaining each watershed process in the absence of human impairment. The use of the term "important areas" is used to distinguish areas that play key roles in how ecosystem processes operate within a watershed, but does not imply that other areas are not important for ecological functioning, land use management, or other purposes. Table 2 in APPENDIX D identifies the data sources for important areas in Wahkiakum County using methods from Stanley et al., 2008, 2012 and from the Thurston County SMP Update Inventory and Characterization Report, 2013.

Multiple processes are often present in single areas. The mapping exercise allowed us to identify areas where each process occurs as well as areas that support multiple processes and therefore may provide valuable protection and/or restoration opportunities.

Step 3 – Overlay Landscape Alterations (Impaired Areas)
The landscape alterations analysis utilizes the results from step 2 (above) combined with an overlay of shoreline alteration (from agriculture, rural and urban development, etc.). This method helped us understand areas where process "important areas" have been changed by human influences to the landscape.

Discussion of ecosystem-wide processes, function and alterations occurs in Chapters four and five below. As mentioned earlier, the assessment was performed at the WRIA scale (See APPENDIX D for map of summarized "important areas" and "impaired areas"), but is discussed in each Hydrologic Unit Code (HUC) 10 watershed section. Management issues and opportunities identified in the ecosystem-wide process are discussed at the end of Chapters four and five in the "Management Issues and Opportunities" section. The ecosystem-wide analysis also identifies land use actions and other potential process impairments as "Impaired Areas". These areas likely alter naturally occurring watershed processes. Impaired areas may provide opportunities for restoration, while unaltered areas may have potential for conservation or similar protection. In some cases it is not possible to map the activities that impair the process. In such cases, mappable indicators were used that strongly correspond to these activities and are easier to map.

2.3.2 Incorporating the Ecosystem-Wide Analysis into the ICR

The aforementioned ecosystem-wide analysis used in this report allows for a relational characterization based on qualitative (not quantitative) evaluation of the nexus between ecological importance and degree of impairment. This is used to identify areas that contribute to both broad ecosystem processes and finer-scale shoreline functions. Areas identified as being highly impacted have degraded ecosystem functions as the result of many issues such as development of impervious surfaces, intensive agricultural practices, fish and wildlife barriers, and other land use actions that degrade the quality and function of the shorelines. The assessment described fully in APPENDIX D and summarized above identifies areas that have been impacted, areas that have high ecological value, and areas with high ecological value that are relatively non-impacted.

The results from this assessment are used in this report to describe current conditions, prioritize management strategies, help guide the establishment of shoreline environment designations (SEDs) that tailor SMP provisions based on differing conditions, and will help guide more detailed evaluation of opportunities for improved functions. The watershed management matrix (Figure 2 below) illustrates the range of management strategies that result from this dual consideration of importance and impairment.

Importance	Highest	Highest Protection	Highest Protection	Highest Restoration	Highest Restoration	Highest Restoration
	High	Protection	Protection	Highest Restoration	Highest Restoration	Highest Restoration
	Medium	Protection	Protection	Restoration	Restoration	Restoration
	Low	Protection/Restoration	Protection/Restoration	Restoration/Development	Restoration/Development	Restoration/Development
	Lowest	Conservation	Conservation	Development/Restoration	Development/Restoration	Development/Restoration
		Lowest	Low	Medium	High	Highest
		Degradation				

Figure 2 Watershed Management Matrix. The importance rating is on the vertical Y-axis, and the impairment rating is along the horizontal X-axis. The combination of these two ratings indicates suitability of the sub-unit for protection, restoration, conservation, or development management strategies. Figure modified from Stanley et al., 2012. See also Map at the end of this section

Chapters 4 and 5 summarize the results from the analysis including maps depicting impaired areas and priority areas of importance for each watershed.

Chapter 7 further discusses SEDs. Shoreline environment designations have specific use and modification policies and regulations designed to protect the existing resources, shoreline functions, and ecological processes to allow appropriate use and development while prohibiting actions that would degrade natural conditions. For example, areas with high-value ecosystem functions that have not been impacted by development (i.e. high importance, low impairment) may receive a more protective SED with more restrictive use and modification regulations. Areas with lower-value functions that are heavily impacted (i.e. low importance, high impairment) may justify SEDs that are more permissive of future use and development.

The results of the ecosystem-wide analysis also provide a first look at areas that should be protected, or areas with high ecological value but are heavily impacted. These high-value, high impairment areas are considered priorities for future restoration efforts described in the separate SMP Restoration Plan.

2.4 Approach to Inventory and Characterization of Regulated Shorelines

The inventory of shorelines of the state in Wahkiakum County and the Town of Cathlamet is intended to characterize conditions in and adjacent to each shoreline waterbody within the County's and Town's SMP jurisdiction. The shoreline planning area roughly approximates the regulatory limits of the Regional SMP as described above. GIS data were used to inventory and characterize conditions at both the broad watershed and finer reach scales (discussed in more detail below). In addition, aerial photography and review of existing reports were used to qualitatively describe conditions in the shoreline planning area.

2.4.1 GIS Analysis and Mapping

GIS data, analysis and mapping were used to characterize shoreline conditions at the HUC-10 watershed and reach scale. GIS overlay analysis was used to quantify certain conditions (e.g., spatial extent of wetlands, land use designations) in the shoreline planning areas. GIS mapping was used to develop the Map Folio that is found in APPENDIX E. A list of GIS data and sources used for the inventory is included in APPENDIX B.

LiDAR, three (3) - and ten (10) - meter Digital Elevation Models (DEMs) were utilized for map-making. For analysis, 10 meter DEMs were utilized unless otherwise specified because the data was continuous across the entire planning area where 3 meter DEMs and LiDAR were not available for large sections of the planning area.

2.4.2 Determining Shoreline Jurisdiction

Shoreline jurisdiction was determined primarily utilizing GIS and is based on Ecology's revised list of shoreline streams using data from several regional flow studies conducted by the U.S. Geological Survey (see also Chapter 1.4). The OHWM was approximated using aerial photography and digitized in ArcGIS. As mentioned on the shoreline jurisdiction map, OHWM is an approximation and the actual site-specific extent of shoreline jurisdiction may need to be determined in the field on a project-by-project basis. A 200 ft. off-set was then established landward from the OHWM mark. Associated wetlands were also mapped to show their relationship to the minimum 200 ft. shoreline jurisdiction. The 100-year floodplain was mapped separately, but is proposed to also be included in the shoreline jurisdiction.

2.4.3 Determining Reach Breaks

To facilitate this shoreline characterization, shoreline planning areas were divided into reaches based on the criteria discussed below. Other reports that previously identified some reaches in Wahkiakum County, primarily on the Grays River, Elochoman River and Skamokawa Creek (LCFRB WRIA Grays-Elochoman Fish and Wildlife Recovery Subbasin Plan 2004; Tetratech et al. 2008) were compared to the reach breaks completed for the SMP update. This comparison identified some general consistencies between these reports and the reaches established for the SMP update. Although due to the criteria used in the SMP reach break determination, several of the previously established reaches were further subdivided. The overall goal of this approach is to be able to more easily categorize reaches by region and further select reaches that capture the hydro-geomorphic conditions or biophysical criteria in the landscape that will impact shoreline form and function within each watershed. The reach breaks also form a basis for the scale of inventory and provide a mechanism for developing and applying shoreline environment designations in later phases. Reach breaks can also be used to calculate linear shoreline lengths and areas (e.g., area of associated wetlands, floodplains, etc.).

Based upon an overview of the watersheds and the landscape setting in Wahkiakum County, the following criteria were used to determine reach breaks along the SMP rivers and streams:

- Breaks at the confluence of two SMP jurisdictional shoreline rivers. The rationale here is that major changes in geomorphology and landscape often occur downstream of major river confluences.
- Breaks based on land cover. Significant changes in land cover often mark changes in habitat, land use, slope, etc.
- Breaks at significant changes in geomorphology. These changes can include: gradient, width of floodplain, width or type of channel migration zone and/or transition in channel form. This will often include the transition from the upper watershed to lower alluvial valley.
- Breaks where significant shifts in the pattern of land use development and/or zoning designations occur.

- Washington State 303d listings of impaired streams. Reaches that had a 303d listing for water quality impairments was figured into the overall determination of reach breaks, although not all reach breaks end and begin where 303d stretches of stream begin and end.

After applying the reach break criteria to all of the SMA rivers/streams in the County, there were a few instances where adjustments were made based upon site specific issues:

- Islands under County jurisdiction generally included the entire island in a reach unless otherwise specified. Many unnamed islands exist within the County. For reach determination purposes, unnamed islands in the vicinity of a named islanded were grouped into an "island complex" where each island "reach" was singled-out and identified by number.

The naming of the reaches is based on HUC 10 watershed and the stream/river that the reach corresponds with. The descriptions and results of the analysis can be found in Appendix A and locations of each reach can be found in APPENDIX E (Maps 58-60). The naming convention for reaches is by HUC 10 watershed followed by river/stream or island complex name and an assigned number. Numbers go from lowest to highest moving downstream from the upstream most portion of the SMP jurisdiction. For example, EFC_NelsonCreek_01, where EFC is an abbreviation of the HUC 10 Watershed i.e. Elochoman – Frontal Columbia, "Nelson Creek" is the name of the waterbody in question and the number (one in this case) corresponds with the specific section of the stream/river. Ultimately, the descriptions of each reach can be found in APPENDIX A and a map of the reaches can be viewed in APPENDIX E (Maps 58-60).

2.5 GIS Data Sources for Reach Sheets

A description of each shoreline reach is detailed in Appendix A. Each reach was analyzed and characterized based on GIS Data. Information and a description of the data sources are also described in Appendix B.

2.6 Data Gaps

Information for the ecosystem analysis was gathered largely from analysis performed for this inventory and characterization report. In general, upper reaches appear to be under studied in terms of hydrologic, land use, land cover and habitat conditions. Overall, data available for some watersheds was more abundant than others and while the report attempts to keep the report consistent in terms of what data is presentated, this is not always possible both in this chapter and chapter 5. For example, Grays and the Elochoman rivers have more data on hydraulics and ecosystem structure. As a result, overall management recommendations are more specific in these areas because the issues are better known.

The ecosystem process analysis (see Appendix D) has several areas where some data was not available for the analysis (highlighted in yellow in Appendix D). The unavailable data includes: data used to identify areas with nitrification issues, upland areas with clay soils used to determine areas of movement via adsorption (T), depositional stream channels and channel gradients (originally provided in data from WDFW that is no longer available). Unavailable data may have impacted the results of the Ecosystem-Process Analysis used to identify impacted and important areas. However, most of the data for the analysis was available and some assumptions regarding areas for development, conservation, protection and restoration can generally be viewed as a starting point for further investigation.

Additionally there were some underlying assumptions from Stanley et al. (2012) regarding the analysis, which field verification may be necessary on a project by project basis. These assumptions include:

1.) In general, topography, the shape or geometry of the aquifer system, and the locations and amount of discharge and recharge control the movement of the uppermost layers of groundwater (Vaccaro et al. 1998).
2.) In general, groundwater flow follows major topographic gradients. Groundwater movement will tend to be from higher areas to lower areas (Vaccaro et al. 1998). LFlows? in Wahkiakum County are generally surface water drainages.
3.) On slopes of less permeable geology, water will move downslope as subsurface flow. If it reaches more permeable deposits when the topography flattens, this water will then move downward to recharge groundwater.
4.) Lakes and large wetland areas (if not on perched water tables) and perennial streams are an expression of the water table or the emergence of groundwater at the surface.
5.) Alluvium and recessional outwash are generally of high permeability.
6.) Till, moraines, organic deposits, lacustrine, glacial marine drift, mudflows, fine alluvium, and bedrock are generally of low permeability.
7.) Advanced outwash can be of moderate permeability, but it may be locally overridden with glacial till (advanced outwash was deposited in front of the glacier and was often subsequently covered with glacial ice). In this instance, permeability should be low since the till layer intercepts percolating water first.
8.) Areas of glacial marine drift are sometimes included within areas mapped as glacial outwash.

Impaired and important areas identified during the ecosystem –wide analysis were from data captured at a particular resolution. Data at some resolutions were not able to capture smaller changes at the reach scale. Therefore watershed-level analysis supplied the best resolution of the data in many cases.

Lastly, how sections are presented may vary depending on the availability information for each waterbody, watershed, etc. For example, the Grays River basin has been extensively studied whereas the information on the Mill Creek area has far less information available. This report makes every attempt to analyze each basin based on the same parameters. Specifics on a particular waterbody may be available when that same information for another waterbody is not.

Chapter 3: County Overview

3.1 Introduction

This chapter provides a broad overview of Wahkiakum County and the Town of Cathlamet. This overview provides background context for the Hydrologic Unit Code – 10 (HUC 10) watershed discussions provided in Chapters 4 and 5 and the reach analysis covered in Appendix A.

Wahkiakum County is located in southwest Washington State and is bounded on the north and west by Pacific County, Lewis County on the northeast corner, on the south by the Columbia River, and on the east by Cowlitz County. The County consists of 264.2 square miles, or 169,088 land total acres. It is one of the smallest and least populated counties in the State of Washington with just less than 4,000 residents. Elevations in the County range from 958 feet above mean sea level (MSL) in the upland mountainous area in the north part of the County, to sea level in the south western portion of the county along the Columbia River. The Ocean Beach Highway (Hwy 4) crosses the county from west to east providing access to/from the I-5 corridor to the east and the Pacific Ocean to the west. The County's ferry boat service provides passenger and vehicular transport from Puget Island to Westport, Oregon located just south across the Columbia's main channel. The County's new 2015 vessel - the 'Oscar B' - is the last operating ferry service on the lower Columbia River. Cathlamet is the county seat and the only incorporated area, with other small areas of concentrated development including the communities of Deep River, Grays River, Rosburg, Skamokawa, East Cathlamet and Puget Island.

The Town of Cathlamet is located along Highway 4 and the Columbia River at river mile (RM) 40 due north across the Cathlamet Channel from Puget Island. Cathlamet is connected to Puget Island by a fixed highway bridge (SR 409). Just down river of the Town of Cathlamet to the northwest is Elochoman Slough which separates the Hunting Islands from the Washington mainland to the northeast. The Town of Cathlamet is seven miles upstream to the southeast from Skamokawa. According to the U.S. Census Bureau, Cathlamet has a total area of 0.50 square miles or 320 acres with a population just over 500 residents. The average elevation is approximately 79 feet.

3.1.1 General description of WRIAs and use of HUC 10 watersheds (Appendix E Map 6)

Wahkiakum County falls within two WRIAs (24 and 25). Most of the County falls within WRIA 25. Part of Naselle River and Salmon Creek flow through Wahkiakum County in the northwest corner of the county, which makes up a relatively small drainage area within WRIA 24. In Wahkiakum County WRIA 24 consists of 2289.34 total aquatic and land acres and WRIA 25 consists of 180,794.43 acres (both aquatic and land acreage). The Town of Cathlamet is in WRIA 25.

HUC 10 watersheds were utilized to further divide the WRIAs and describe region-wide characteristics regarding ecosystem function and structure and land use. Naselle River – Frontal Willapa Bay watershed makes up the small portion of WRIA 24 located within the County. The following HUC 10 watersheds all contain jurisdictional shorelines and are located within WRIA 25:

- Wallacut River – Frontal Columbia River
- Grays Bay (Grays River) – Frontal Columbia
- Baker Bay – Columbia River
- Elochoman River – Frontal Columbia River
- Cathlamet Channel – Columbia River
- Germany Creek – Frontal Columbia River

The physical and biological characteristics of each WRIA are described according to each HUC 10 (below). Sequencing the successive chapters in this way allows the reader to keep focus on each watershed as a whole from the identification of problems to possible corrective measures. Many of the HUC 10 watersheds extend into other counties. This characterization report only covers the portions of the watersheds within Wahkiakum County unless otherwise specified.

3.2 Regional Overview

3.2.1 Climate

Precipitation in WRIA 24 ranges from 60 inches per year near the coast in Pacific County, to 140 inches per year in the Willapa hills and upper headlands including areas in northwest Wahkiakum County. In WRIA 25, much of the county overall sees an annual precipitation ranging between 45 to 118 inches per year, with an average of 70-85 inches (See Figure 3.1). Lighter rainfall generally occurs in the southeastern section of the county with the highest amount of precipitation falling in the rugged terrain that parallels the northern border of the county. The relatively low elevation and moderate annual temperatures limit snowfall to generally light and short duration episodes. Average daily temperature ranges between 31 and 46 degrees Fahrenheit in the winter and 50 to 76 degrees Fahrenheit during the summer. During the summer, prevailing winds occur from the north, northwest and west. During the winter, winds shift and come from the east, southeast and south.

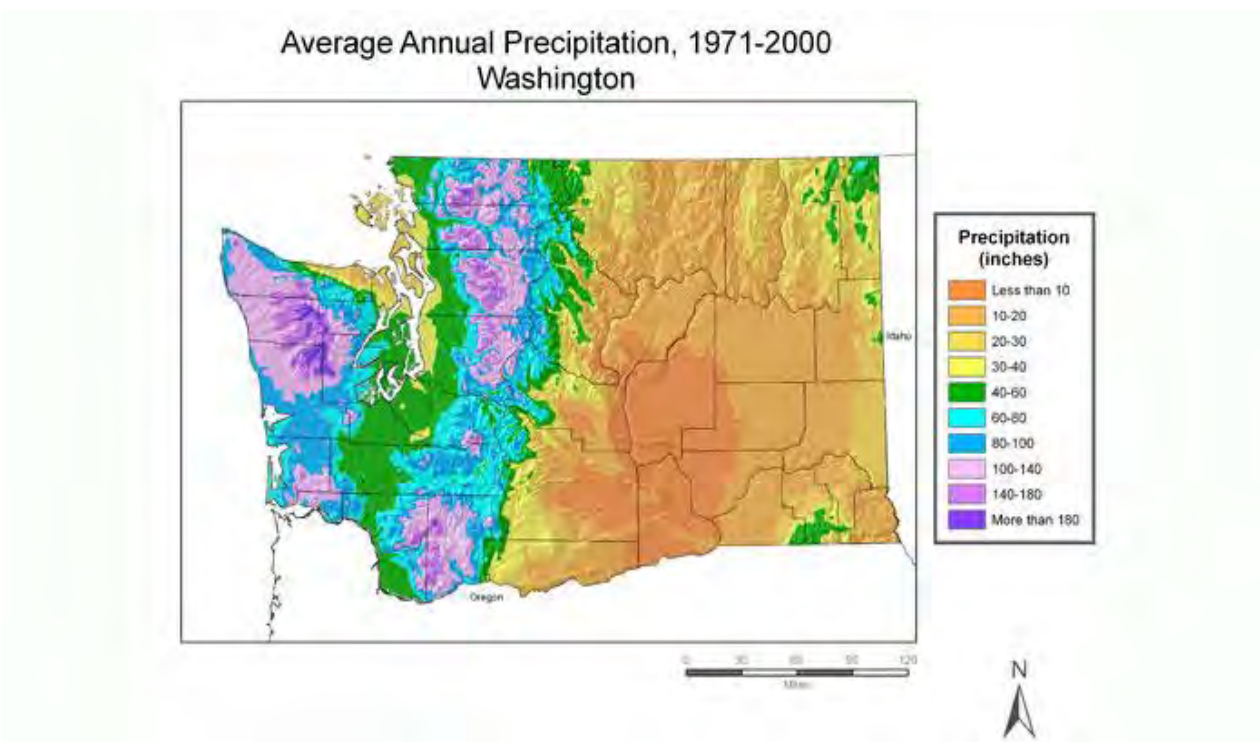


Figure 3.1 Washington Average Precipitation (1971-2000)

3.2.2 Geology

Most of the WRIA 25 and all of WRIA 24 lie within the Coast Range province (See Figure 3.2). The eastern portion of WRIA 25 includes Columbia River basalt flows and other geologic units that serve as important aquifers (LCFRB 2001). The majority of Wahkiakum County (eastern portion of WRIA 24 and the western portion of WRIA 25 is located within the Willapa Hills Geologic subprovince (Cowlitz-Wahkiakum Council of Governments 2008).

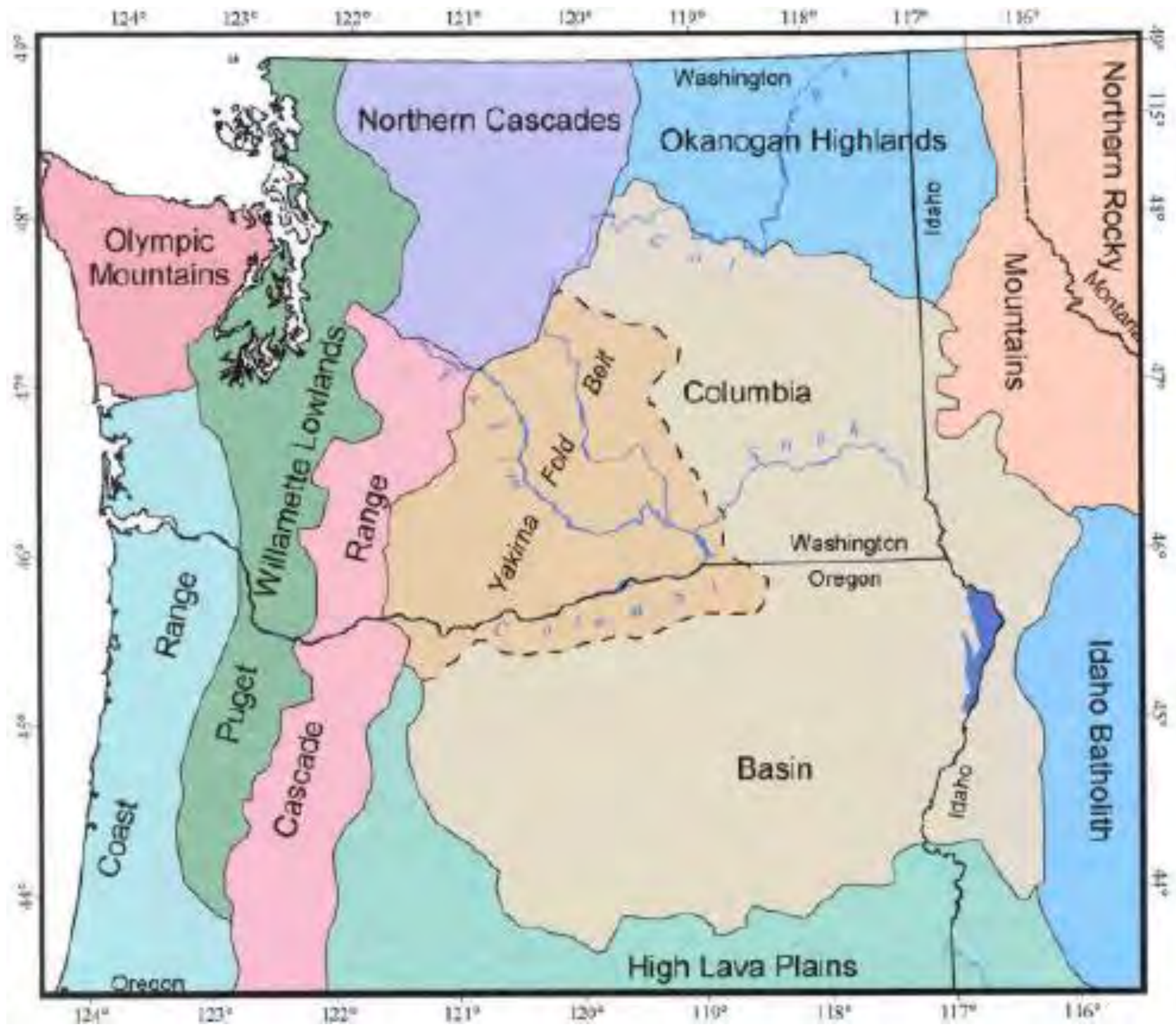


Figure 3.2 Geologic Provinces

The eastern portion Elochoman River basin also includes Columbia River basalt flows and other geologic units that serve as important aquifers. Geology of Wahkiakum County influences the development of soils, slope stability, and dictates stream substrate within a watershed. The Willapa Hills are part of the Coast Range and include the adjacent valleys that open up to the Pacific Ocean. Estuarine embayments along the low-lying shoreline of the Columbia River characterize Columbia River frontal Wahkiakum County. The geology is a mix of basalt, sedimentary and volcanic rock. The bedrock comprises a series of moderately folded tertiary formations of volcanic and sedimentary rock, oriented with a north-south deformation. The Columbia River Basalt group contains columnar jointing and pillow lava, some flows over 100 meters in thickness. Flows of Columbia River basalt followed ancestral courses of the Columbia River until they reached the Pacific Ocean at Willapa Bay and Grays Harbor.

As it flowed to the sea, meltwater from continental glaciers carved a wide valley along the present-day Black and Chehalis Rivers. However, most of the province was never glaciated, so ridges and hills have a rounded topography and a deep weathering profile. The descent to the Columbia River on the south is generally precipitous, but elsewhere the hills merge gradually into the surrounding lowlands. Evidence for large earthquakes on the interface of the Juan de Fuca and North American tectonic plates is preserved in coastal marshes of this province.

The geologic provinces in Wahkiakum County generally consists of rugged mountainous uplands, a surrounding belt of low hills, and areas of relatively broad, flat floodplains located along the southern fringe of the County adjacent to the Columbia River. Though the Willapa Hills contain rugged, mountainous country, most of the region is less than 2,000 feet in altitude. The steep canyons and tributary streams brought sand and gravel to the lowlands, where much of the settlement has occurred on alluvial soils. These river valleys are connected to adjacent floodplains that border the Columbia River. Runoff from the steeply-rising foothills frequently leads to flooding of valley floors (Washington DNR Division of Geology and Earth Resources; WRIA 25 & 26 Watershed Management Plan). A map of the geologic units (Map nine and 10) in Wahkiakum County can be found in APPENDIX E.

Ecological processes related to geology include geomorphic processes such as the interaction of water, sediment and creates channel and shoreline structure. This includes bank and bed erosion, channel migration and evolution, sedimentation, debris input, and accretion. Geologically hazardous areas, such as landslide areas contribute to natural sediment inputs that create habitat and carry nutrients downstream.

3.2.3 Soils

The Soils Survey historically conducted by the U.S. Soil Conservation Service (now the USDA Natural Resources Conservation Service (NRCS)) includes a series of soil maps which can be used for regional planning. The survey provides information regarding suitability for agriculture, residential development, recreational uses, woodland and wildlife habitat, and other uses. The soil map (Map 7 and 8 in APPENDIX E) identifies the different soil series in the county.

Soils in Wahkiakum County consist of several properties that combine to create unique soil associations that affect the suitability of the soil for various uses. Load-bearing capacity, hydric soils, erosion potential, and shrink-swell action all play a significant role in development of land. Hydric properties are particularly relevant to determining potential for on-site waste treatment, the presence of wetlands, or other environmental concerns. Soils can also be designated as "prime agricultural" or "unique agricultural" soils. Prime agricultural soils are optimum for growing crops and livestock and are generally located in the floodplains of the major rivers/streams in Wahkiakum County including Skamokawa subwatershed, Elochoman River subwatershed, Grays River, Deep River, and on Puget Island on the Columbia River (See Figure 3.3). Unique agricultural soils are generally suited for specialty crops.

Figure 3.3 Prime Agricultural Soils in Wahkiakum County. Browns indicates the areas in the county which are most suitable for farming. Greens and yellow indicate potential areas for farmland. Maintaining and protecting these soils is critical to the continued success of agriculture in the county.

Wetland areas are characterized by hydric soils that are susceptible to flooding, ponding or saturation. Only the Ocosta association and the Rennie soils are designated in the Soil Survey as hydric soils, although low-lying soils or depressions involving other soil groups can experience saturation and ponding. These are typically located within the low lying floodplain areas, and experience saturation and ponding at the soil surface. The deep but poorly drained Ocosta soils are found along coastal bays, and have a high water table. Rennie soils are silty clays typically located along drainage ways and depressions. Each of these soil associations is suitable for silage, pasture, field crops, wildlife and wetland habitat. Development limitations include flooding hazards and a seasonally high water table.

3.2.4 Wetlands (Appendix E Maps 1 & 2, 24 & 25)

Wetlands, in general serve a variety of functions as part of ecosystem-wide processes. These processes include hydrologic movement of surface waters and water storage, sediment and nutrient movement and the movement of water, sediment, and large woody debris. These processes are representative of the functions served by wetlands including water storage, removal of sediment, toxins and nutrients, and providing habitat for a variety of species that play an important role in food web connections.

Wetland functions serve important roles that contribute to ecosystem processes such as nutrient cycling, surface water storage and groundwater recharge areas that affect the watershed. These processes are the result of the structure and function that wetlands provide in the watershed.

Structure (vegetation type, hydraulic connections to other waterbodies, etc.) is often dictated by the other factors discussed such as geology, soil type and climate. As a result, the structure and function of these wetlands play an important role in the ecosystem processes that contribute to shoreline resources.

3.2.5 Channel Migration Zones (see Appendix E Maps 11, 12 and 13)

Areas affected by stream meandering or channel migration, the horizontal and vertical movement of a river or stream channel across its valley bottom, are called Channel Migration Zones (CMZs). A CMZ includes the area within which a stream channel can be expected to migrate over time due to its hydrology and geomorphology. Channel migration is an important natural process that supports many ecological functions, including formation of fish and wildlife habitat. Channel migration can occur gradually by natural or exacerbated erosion, or abruptly by incision events that deepen the channel or by avulsion events where a stream 'jumps the tracks' to abandon its existing channel to create a new one.

CMZs are also a type of flood hazard area and therefore are considered a critical area under the County's and Town's Critical Areas Ordinance (CAO). The flood hazard to people and structures within a CMZ is due to bank erosion or outright channel relocation rather than getting inundated by overbank flow. Although both channel migration and flood inundation are hazards due to flooding, there is no specific correlation between the mapped boundaries of the two hazard areas. The area within a CMZ and its associated flood hazard may extend beyond the 100-year floodplain or the 100-year floodplain may extend beyond the CMZ. Therefore, it is necessary to identify CMZs as a hazard area separate from the floodplain. The planning level channel migration assessment completed for this report is described in Chapter 2.

Headwater channels in the steeper erosion and sediment production areas and areas dominated by sediment transport may not show significant channel migration over time scales of a few decades. Areas of deposition (lower river/stream reaches), especially the transition from a transport to a depositional zone, would be areas of likely channel migration (Church 1983; Montgomery and Buffington 1993). These conditions exist where channel gradient and confinement decreases markedly, such as where a steeper river emerges from foothills onto a broad, flat floodplain. Additionally, levees, roads, shoreline armoring and channelization limit the ability for river and stream channels to migrate naturally in the lower reaches.

Along rivers, potential channel migrations zones (CMZs) are present in all locations of the 100-year floodplain. Maps 11-13 in Appendix E provide a general indication as to where channel migrations is likely to occur in Wahkiakum County and the Towns of Cathlamet. Major active channel migration areas include the upper Grays River basin in Hull Creek, West Fork – Grays River and in upper Fossil Creek. Active channel migration areas occur in Skamokawa Creek upstream of the West Fork of Skamokawa Creek, particularly in Wilson Creek and between Standard Creek and Falk Creek. In the Elochoman River, active channel migration areas occur throughout the watershed as far downstream as below Beaver Creek to the headwaters. .

3.2.6 Flood Prone Areas

Frequently flooded areas include flood hazard areas and are considered a critical area under the County's and Town's Critical Areas Ordinance (CAO). According to the Washington State Hazard Mitigation Plan, river systems in Wahkiakum County that result in the most frequent flooding include the Grays River, Elochoman River and the Columbia River. Flooding occurs resulting from two basic factors: general flooding of the river system, and flooding resulting from development. Wahkiakum County has one of the highest percentages of land area within the 100 year floodplain in the state with 9.1 percent (Cowlitz-Wahkiakum Council of Governments 2006). The Shoreline Jurisdiction map (Map 1 and 2) in APPENDIX E identifies the 100-yr flood areas and the Flood Risk map (Map 16 – 18) shows mapped floodways of the Skamokawa and Elochoman systems, the 100-year flood hazard areas, and upland areas outside the 500-year flood risk area. Wahkiakum County has produced a Comprehensive Flood Hazard Management Plan (2006). Section VI of the plan outlines strategies for addressing issues such as aggradation, erosion, overbank flooding, and localized flooding. Several maps were produced by CREST (2002) as part of the Wahkiakum County Flood Hazard Management Plan (2006) and are a collection of previous data, public meetings, and local input to identify flood prone areas and hazards that may result in flooding issues in Wahkiakum County. Figures 3.4, 3.5 and 3.6 shown in this section are flood issues identified in the aforementioned report and are referenced in other sections below.

Figure 3.4 Areas of overbank flooding (CREST 2002).

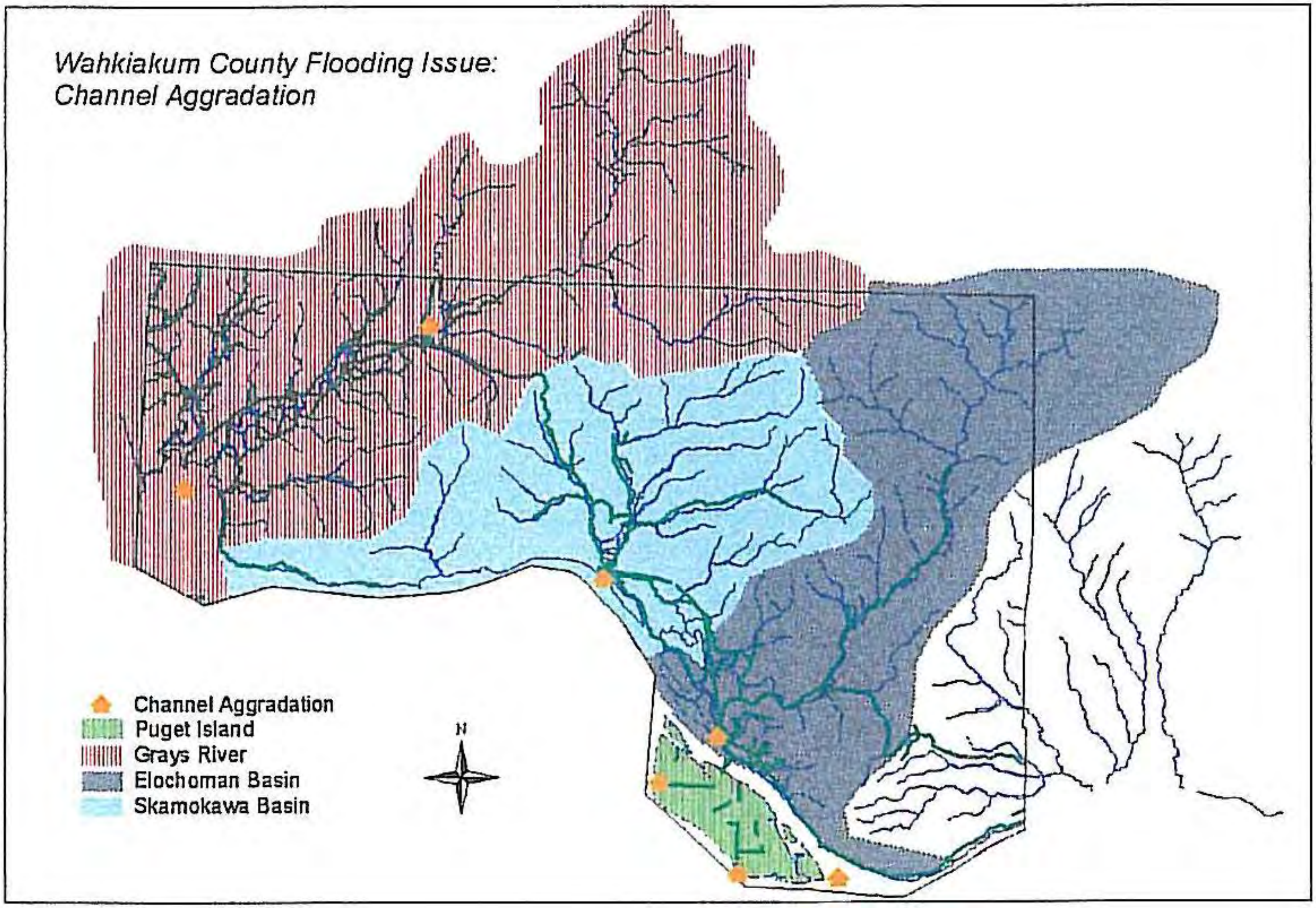


Figure 3.5 Areas of channel aggradation (CREST 2002).

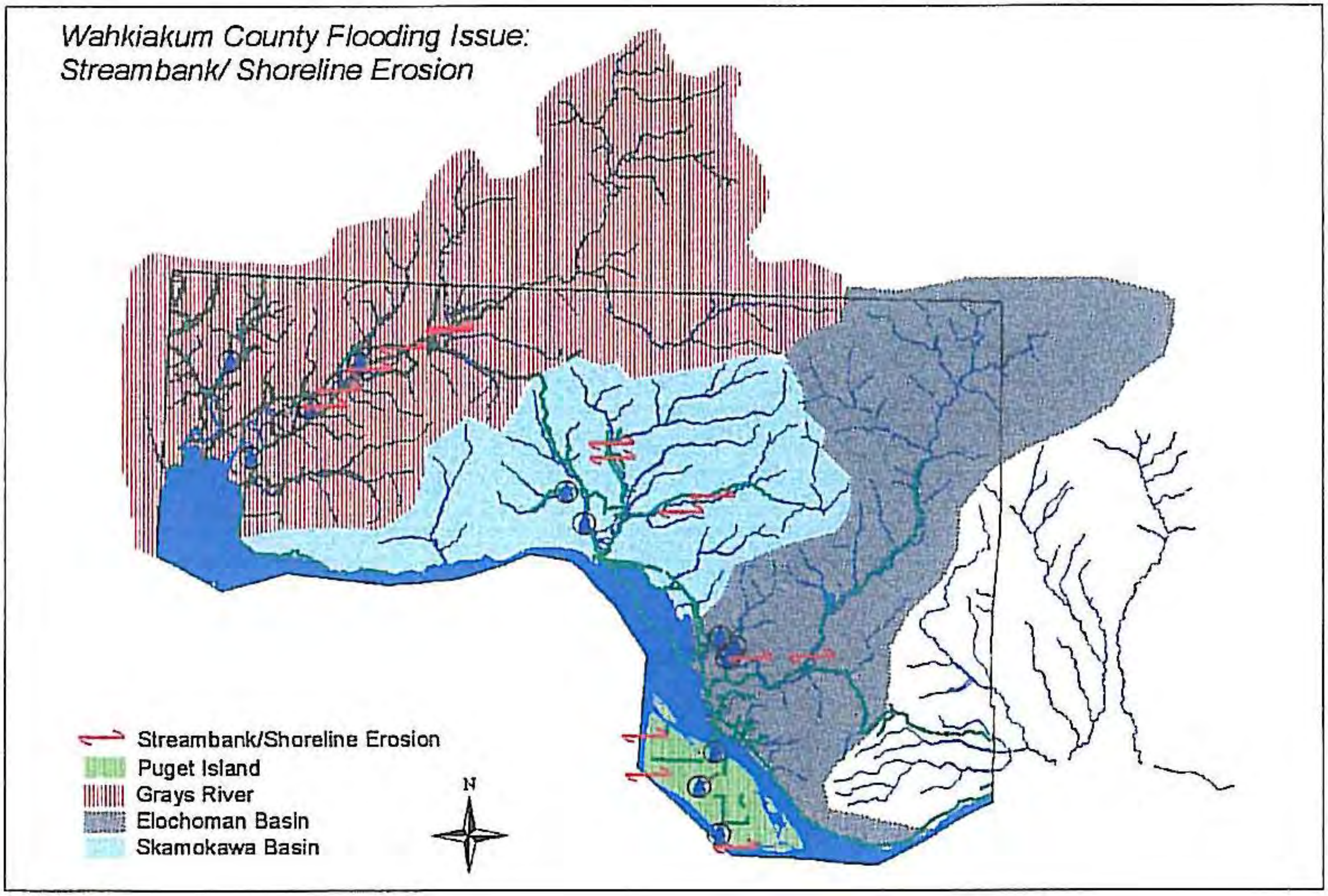


Figure 3.6 Areas of streambank/shoreline erosion (CREST 2002).

3.2.7 Geologically Hazardous Areas (Appendix E Maps 19 – 22)

The combination of geology, soils and other factors creates a range of conditions expressed as various ecosystem processes and shoreline functions. While these important natural occurrences create channel and shoreline structure (geomorphology), contribute sediment and debris to help form habitat and move nutrients downstream, areas that are susceptible to erosion, sliding, earthquake, or other geologic events can pose a threat to public health and safety. As previously noted, the CAO classifies and designates these as critical areas to protect people, property and ecologically sensitive features. Where these critical areas occur along streams and rivers in shoreline jurisdiction, SMP policies and standards must provide protection.

Landslide areas of high hazard soils are located in steeper terrain where unstable slopes, mass wasting, and debris flow can be exacerbated by land use and development activities. Low-lying areas such as floodplains and wetlands generally have a higher risk of liquefaction, a phenomenon in which the strength and stiffness of soil is reduced by seismic shaking. Moderate to high risk liquefaction hazards occur along the major drainages of each HUC 10 watershed and all of Puget Island. More specific descriptions are provided in Chapters four and five.

3.2.8 Fish & Wildlife Habitat (Appendix E Maps 26 – 27)

The combination of topography/bathymetry, hydrology and other factors also creates a range of both in-water and riparian upland habitat important to species of local, state, and federal significance. A variety of birds, fish, mammals, reptiles, amphibians and benthic organisms rely on the array of channel morphology, woody and herbaceous streamside vegetation, and natural processes that connect land and water. Endangered salmonids and other species are a priority focus for many organizations and efforts across the landscape. Again, the CAO establishes fish and wildlife habitat conservation areas (FWHCA) for such priority habitats and species, and for commercial/recreational shellfish, ponds, waters stocked with game fish, natural resource conservation areas, and waters of the state. Areas with significant saltwater or freshwater habitat not already designated as FWHCA critical areas also provide shoreline functions and support key species. Protecting and restoring these important shoreline resources helps ensure no net loss of ecological functions. More specific descriptions of these features are provided in Chapters four and five.

3.3 Groundwater (Appendix E Maps 14 & 15)

The principal hydrogeological units that yield the largest quantities of ground water to wells within WRIA 25 are the unconsolidated sediments that occur in the Grays River system valleys and along the Columbia River. Historically, these units have yielded between five and 500 gpm to wells in the Grays River system and from 500 to greater than 3,000 gpm near the Columbia River (LCFRB 2001).

The other geologic units that have the potential to produce sustainable ground water yield include the Wilkes Formation of the Continental Sedimentary Rock Units and the Columbia River Basalt Group (CRBG). However, yields in these formations are variable. Typical yields are on the order of

50 gpm in the Continental Sedimentary Rock Units and as high as 1,200 gpm in the local portions of the CRBG (LCFRB 2001).

No comprehensive mapping of exempt (domestic) wells is available to evaluate whether areas of dense well clusters exist that may impact stream water levels. However, based on estimated total ground water use and a 20-year projected population increase in 2001, the ground water withdrawal does not appear to be significant (LCFRB 2001).

This characterization report also discusses critical aquifer recharge areas, which are important areas to consider for protection for land use planning purposes and are covered in the County's and the CAO along with wetlands and geologic hazard areas. Aquifer recharge areas are part of a drainage basin where the flow of groundwater in the saturated zone is directed away from the water table surface. Aquifer discharge areas are where the flow of groundwater is directed toward the water table surface. Recharge area flow is directed downward near the ground surface (Freeze and Cherry, 1979).

Recharge is water that is added to ground water from a number of sources including rainfall or snowmelt that infiltrates through the ground and is an important contributor of groundwater storage and movement; an important ecosystem-wide process(Morgan 2005). Recharge can come from quite a distance through the ground over a long period, or it can come from relatively local and more recent sources. Rain and surface waters drain through generally porous soils and add to the underground groundwater supplies. Recharge areas replenish groundwater supplies, but also allow for introduction of contaminants into the upper most unconfined aquifer. Typically, around 70 to 90 percent of a drainage basin will be a groundwater recharge area (Dingman, 2002).

In Washington, Critical Aquifer Recharge Areas (CARAs) are defined as areas "where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water" (WAC 365-190-030). All groundwater is potentially vulnerable to contamination. However, data on groundwater contamination shows that problems vary spatially and not all regions are equally vulnerable (Merchant, 1994). These areas are not currently mapped for the County, so potential aquifer recharge areas were determined for this report by identifying geological units that are known for having a high to moderate rate of permeability. Additional information such as wetlands, streams, and well information was also utilized to determine where recharge areas might be located.
Ground water is directly linked with all of the critical areas including wetlands, fish and wildlife habitat, critical aquifer recharge areas, frequently flooded areas, and geologically hazardous areas. It is a source of water to streams, lakes, estuaries, wetlands, and springs. As a result, ground water provides an important function for wildlife and fish habitat. Additionally, ground water is often a key factor in flooding and geologic hazards. (Morgan 2005).

A variety of factors has the potential to contribute to the degradation in quality of ground water supplies. These factors include point pollution sources (from specific, identified land uses) as well as "non-point" pollution sources (the cumulative impacts of many land uses taken together), shallow depth to the aquifer, and unprotected ground water supplies. (Wahkiakum County Draft Comprehensive Plan 2008).

Ground water is the primary source of drinking water in Wahkiakum County (Wahkiakum County Draft Comprehensive Plan 2008). Information on ground water quality is fairly limited.

However, the information available suggests that, in general, water quality is currently in good condition (Wahkiakum County Draft Comprehensive Plan 2008).
Cathlamet source of domestic water is the Elochoman River.

3.4 Water Quality

Water quality in Wahkiakum County varies considerably due to number of surface and groundwater sources as well as impacts from land uses in the lower and upper watersheds. The water quality map (Map 23)) in APPENDIX E identifies Clean Water Act Section 303(d) and 305(b) issues throughout Wahkiakum County and in the Town of Cathlamet.

Section 303d protection and improvement of surface water quality is an important objective of the WRIA 25 and 26: Grays-Elochoman and Cowlitz Detailed Implementation Plan (Manlow and Andrews 2008). Programs are in place to help protect and improve water quality in WRIA 25. The primary vehicle for achieving compliance with state criteria for surface water quality is the Ecology's Total Maximum Daily Load (TMDL) program, also known as Water Cleanup Plans.

As required by section 303(d) of the federal Clean Water Act (CWA), each state must identify polluted water body segments and submit a list of these water quality limited estuaries, lakes, and streams to the U.S. Environmental Protection Agency (USEPA). To qualify for the list, it must be determined through water quality monitoring that the water body segment does not meet state surface water quality standards and that water quality is not expected to improve within the next four years. The standards are the criteria to ensure that water may be beneficially used for multiple purposes such as fishing, swimming, drinking, and fish habitat. Water quality assessments divide waterbody impairments into 5 Categories (listed below):

Category 1 **- Meets tested standards for clean waters**: placement in this category does not necessarily mean that a water body is free of all pollutants. Most water quality monitoring is designed to detect a specific array of pollutants, so placement in this category means that the water body met standards for all the pollutants for which it was tested. Specific information about the monitoring results may be found in the individual listings.

Category 2 **- Waters of concern**: waters where there is some evidence of a water quality problem, but not enough to require production of a water quality improvement (WQI) project (including total maximum daily load [TMDL]) at this time. There are several reasons why a water body would be placed in this category. A water body might have pollution levels that are not quite high enough to violate the water quality standards, or there may not have been enough violations to categorize it as impaired according to Ecology's listing policy. There might be data showing water quality violations, but the data were not collected using proper scientific methods. In all of these situations, these are waters that need continual testing.

Category 3 **- Insufficient data:** water where there is insufficient data to meet minimum requirements according to Policy 1-11.

Category 4 **- Polluted waters that do not require a TMDL**: waters that have pollution problems that are being solved in one of three ways:

- ***Category 4a*** **-** has a TMDL: water bodies that have an approved TMDL in place and are actively being implemented.
- ***Category 4b*** **-** has a pollution control program: water bodies that have a program in place that is expected to solve the pollution problems. While pollution control programs are not TMDLs, they must have many of the same elements and there must be some legal or financial guarantee that they will be implemented.
- ***Category 4c*** **-** is impaired by a non-pollutant: water bodies impaired by causes that cannot be addressed through a TMDL. These impairments include low water flow, stream channelization, and dams. These problems require complex solutions to help restore streams to more natural conditions.

Category 5 **-** Polluted waters that require a TMDL or other WQI project: the traditional list of impaired water bodies traditionally known as the **303(d) list**. Starting with the 2008 Water Quality Assessment, Washington's 303(d) list of polluted waters were placed under Category 5 in the approved assessment.

The 303(d) listings shown on Map 23 in Appendix E consists of only Category 5 listings and the 305(b) listings show all waters and all Categories in the County.

Map 23 in Appendix E also shows impervious surface within the Town and County. Many water quality issue such as temperature, are related to the decrease in riparian vegetation and the ability of water move more efficiently over the surface of impervious areas.

At the time the Watershed Management Plan was developed, Ecology's 2012 303(d) list served as the State's official list of impaired water bodies. 27 of the 187 reaches (14%) in the WRIAs 24 and 25 planning area are on the 2012 303(d) list. Rivers and associated tributaries within SMP jurisdiction boundaries in Wahkiakum County that do not contain 303 (d) listed reaches include:

- Naselle River
- Salmon Creek
- Deep River
- Mill Creek *

*Upper Mill Creek, which is not in SMP Jurisdiction, is listed as a 303(d) for temperature, but no sections within the SMP jurisdiction of mainstem Mill Creek are listed.

Listed impaired stream reaches include river and tributary reaches in the Columbia River (North, south, and east of Puget Island), Elochoman River, Skamokawa River, Jim Crow Creek, and Upper Grays River. All impaired reaches, with the exception of the sections of the Columbia River, are listed for water temperature. The Columbia River is listed as impaired for (Category five, two, three, seven and eight TCDD) Dioxins. The water quality map (Map 23) in APPENDIX E shows the locations of these water quality issues.

Water temperature monitoring by WDFW on the Elochoman River at the Beaver Creek hatchery has recorded numerous excursions beyond temperature criteria. Wahkiakum Conservation District (WCD) monitoring in the summer of 2000 revealed that temperatures in the Lower Elochoman regularly exceed 18ºC (64.4ºF) in August and the first half of September. Monitoring in the Upper

Elochoman and tributaries revealed cooler temperatures with no exceedance of state standards (Wade 2002 and LCFRB 2010).

Water quality issues impact shoreline ecological function. A common example across watersheds is listings resulting from instream water temperature issues. Water temperature can impact the ability for important species such as salmonids to utilize their historic habitat for migrating, spawning and rearing as well as the potential for warmer water species to invade reaches of stream have become warmer. Some causes for an increase in temperature include a decrease in riparian vegetation stream cover, increased impervious surface runoff, and upland clear cutting. Without the shade effect that streamside and upland vegetation provides, water warms with more exposure to the sun, and runoff from built surfaces (pavement, rooftops, etc.) typically heats up more than surface/subsurface flow across vegetated areas. Warmer water typically carries less oxygen, has different chemistry, and changes the composition of aquatic flora & fauna.

SMP planning plays an important role in conserving vegetation in riparian areas by establishing buffers, setbacks, and regulated uses that protect and/or restore native vegetation along the shoreline to help improve water quality by filtering pollutants, fine sediments, and providing shade in a stream that mitigates stream temperature.

3.5 Land Use

Wahkiakum County is a rural county with forestry and agricultural as the primary land use drivers. Forested lands make up approximately 77 percent of the land cover in WRIA 25. Non-forested and logged lands represent about 11 percent of the land area. Agriculture represents approximately eight percent of the land, while Development represents two percent in WRIA 25. According to the Draft Comprehensive Plan for Wahkiakum County (Prepared by CWCOG 2006 and edited by WC BOCC 2008), the population is expected to increase by 37 percent between 2000 and 2020 with an annual growth rate of 1.8 percent (Cowlitz-Wahkiakum Council of Governments 2006). More detailed description of land use and land cover for HUC 10 watersheds and the Town of Cathlamet is presented in Chapters 4 and 5.

3.6 Cultural Resources

The intent of this section is to describe how archaeological and historic resources are managed, , and provides a summary of the historic resources in Wahkiakum County and the Town of Cathlamet..

The Shoreline Management Act Guidelines state that if archaeological or historic resources have been identified in shoreline jurisdiction, the local government is required to collect information about these resources and contact the state Department of Archaeology and Historic Preservation (DAHP) and affected indigenous Tribes.

3.6.1 Defining Archaeological and Historical Resources

Cultural resources include prehistoric and historic archaeological sites, and above ground historic buildings, structures, areas, and districts that have been formally registered as landmarks or otherwise identified as historically significant by the County, State, or Federal Government. DAHP maintains lists of cultural resources and historic sites.

The Washington Heritage Register (WHR) recognizes historic and cultural properties that are significant to local communities and to the state. The program is administered by DAHP. Consideration must be given to the effects of land use actions on WHR properties under the Washington State Environmental Protection Act (SEPA). Properties nominated to the National Register automatically receive listing in the Washington Heritage Register.

The National Register (NR) is a listing of the country's most significant historical properties, is administered by the US Department of the Interior, National Park Service and state-wide by the Washington State DAHP. Consideration must also be given to the effects of land use actions on National Register properties under the SEPA during project review.

3.6.2 Wahkiakum County Modern History

One of the first known non-native american visitors to the area was Captain George Vancouver who sailed up the Washington coast in 1792. Lewis and Clark arrived in 1805.

During the 1800's, the Oregon Trail brought missionaries and settlers to the County. The Columbia River was a main "road" through the County when winter and spring rains made road passage impossible. During that time, fishing and lumber were important local industries. Sawmills and canneries were built and provided employment. Dairy farms and other agricultural industries on Puget Island were also important contributors to the regional economy (Kandoll, 2008). ()

3.6.3 Cathlamet

The Town of Cathlamet is the county seat of Wahkiakum County. In 1846, James and Charlot (Beaulieu) Birnie staked a land claim in what is now Cathlamet when James retired from the Hudson Bay Company (HBC). James called the area Birnie's Retreat. He built his family home and established a trading post buying merchandise for the trading post directly from the HBC. Additionally, in 1850 William Strong, the Oregon Territorial Circuit Judge, took out a land claim with his wife Lucretia (Robinson) at what is now the site of the Wahkiakum County Historical Society Museum.

Historic buildings in the Town of Cathlamet include: the Julia Butler Hansen House built by James Birnie for his sister Rose (first school teacher) and her husband George Roberts in 1857. Doumit Law Office built in about 1870 by James Birnie for his daughter Charlotte (Birnie) Dorcy Ilsley. The Bradley Inn was built in 1907 by the logging company owner Henry Armstrong. Warren Cannery (salmon) was built in 1869 by Frank Manley Warren who later died on the Titanic. John West built a home in 1897 for his daughter Christina and her husband, Captain David Ingram (Kandoll, 2008).

3.6.4 Puget Island

Puget Island is located on the Columbia River across from the Town of Cathlamet. Prior to European settlement, Native Americans used the island as their hunting and fishing grounds. European settlement resulted in the construction of the levee system on the Island in the late 1800's. Soon after, many residents began farming the land (Kandoll, 2008).

3.6.5 Skamokawa

Skamokawa means 'smoke on the water'. It is named after the fog which drifts down the three valleys opening onto the town and the Columbia River. It was once an Indian village long before the white settlers came to the region. In 1851, Chief Skamokawa sold the land to the United States Federal government. The white settlers renamed the area "Skamokawa" after the last Chief of the Wahkiakum Indians (Kandoll, 2008).

In 1844 Captain John Couch built a small trading post near Chief Skamokawa's home. A permanent settlement began in the 1860's and 1870's with the development of logging and salmon fishing (Kandoll, 2008). (

Just southeast of Skamokawa is the Columbian White-tailed Deer National Wildlife Refuge, which was established for the endangered deer and a number of waterfowl species. There is a viewing area built where Roosevelt Elk often browse. In town, the Redman Hall is the home of the 'Columbia River Interpretive Life Center' and was originally the Skamokawa Central School built in 1894 (Kandoll, 2008).

3.6.6 Grays River

Grays River has a small community center, with existing structures dating back 1905 and also includes the Grays River Covered Bridge, located on Loop Road, which is registered on the National Historic Register. That same year, the Grays River Grange #124 hosted the first "Grays River Grange Fair" that year. The Lower Columbia Co-Operative Dairy Association building was built in 1916 and is now a private residence. The newspaper "Wahkiakum Forum" and later the "Grays River Builder" began publication in Grays River (Kandoll, 2008).

3.6.7 Rosburg

Rosburg was settled by German immigrants, Christian and Maria (Brix) Rosburg, in 1893 with Christian being the first postmaster. The Rosburg Store was originally located at the river's edge but is now located next to the highway (Kandoll, 2008).

3.6.8 Deep River

Deep River was originally named "Alimencut" by the Chinook Indians with the early settlers renaming the area "Deep River". Historic structures include the Deep River Cemetery and the Deep River Holy Trinity Evangelical Lutheran Church built in 1902 (Kandoll, 2008).

3.6.9 Potential for Archaeological and Historic Resources

Wahkiakum County lies within the broad tidal estuary near the mouth of the Columbia River. This location provided for one of the richest indigenous populations within North America prior to European exploration and settlement. Following American fur trader Robert Gray's exploration up the Columbia River in 1792, traders and settlers began to call Wahkiakum County home. In 1853 the Territorial Legislature carved out eight new counties, which included Wahkiakum. Given the area's long history both pre- and post-European exploration and settlement and that these early inhabitants primarily settled along the County's shoreline, a number of known and unknown archaeological and historic sites are expected to be located within shoreline jurisdiction. These sites include the following:

- Lithic scatters and caches
- Pre-contact habitation sites (camps, villages, cave sites, etc.)
- Resource procurement sites (fish traps)
- Pictographs and petroglyphs
- Historic habitation sites (homesteads, farms, cabins)
- Historic agricultural infrastructure
- Historic, including pre-contact, transportation corridors (trails, routes, railroad grades, road grades)
- Burial sites

Some, if not all, of these sites may be on or near the ground's surface and others may be deeply buried, depending on the localized geomorphology. In addition to recorded resource sites, it is likely that hundreds or even thousands more cultural resources have not been recorded. Many recorded and unrecorded resources are likely to be encountered in the future within the shoreline area. Within Wahkiakum County, the DAHP lists 41 known archaeological sites, districts and cemeteries falling within their jurisdiction as of July 2011.

3.6.10 Regulatory Overview

In addition to the Shoreline Management Act, regulations relevant to the inventory and management of historic and cultural resources in Wahkiakum County and the Town of Cathlamet include:

- RCW 27.53 (Archaeological Sites and Resources) makes it illegal to knowingly disturb an archaeological site on public or private lands without a state-issued permit. Both known and unknown sites are protected.
- RCW 27.44 (Indian Graves and Records) makes it illegal to knowingly disturb Native American cairns, petroglyphs, pictographs, and graves on public or private lands without a state-issued permit. Selling of any Native American Indian artifacts or remains removed from a cairn or grave is also illegal.
- RCW 42.56.300 (Certain personal and other records exempt) makes archaeological site location information exempt from public release in order to diminish the risk that sites will be vandalized or looted.
- WAC 25.48 (Archaeological Excavation and Removal Permit) establishes procedures for application for and issuance of state permits for excavation and/or removal of archaeological sites and resources.
- Wahkiakum County/Town of Cathlamet Shoreline Master Program (Chapters 5.2.3 and 6.1.1 – Archeological and Historic Resources) establishes goals, policies, and regulations to protect archaeological and historic resources in shoreline jurisdiction as consistent with other existing laws and authorities.

3.6.11 Cultural Resources and Shoreline Development

Given the importance of shoreline locations throughout the human history of the area, the potential for cultural resources needs to be considered for any shoreline development permit unless demonstrated otherwise. Shoreline areas near stream/river confluences need to be considered especially sensitive when development is being proposed. To comply with state and local law, applicants should be prepared to follow the provisions of applicable federal, state and local laws if cultural resources are identified or encountered during the planning or construction process.

3.6.12 Cultural and Historic Resources within Shoreline Jurisdiction

Shorelines have long been a focal point of human habitation and activity throughout history. Indigenous peoples originally occupied shoreline areas that had attributes such as low-bank shorelines, especially near freshwater stream confluences, lowland stream reaches with fish runs, and large rivers having these attributes. These areas attracted human activity due to their ecological richness, access to important food supplies, trade routes and other similar advantages.

Wahkiakum County's archaeological and historical cultural resources extend back thousands of years to the earliest habitation of indigenous people, which include the Chinooks, Clatsops, Cathlamet-Wahkiakums, and Coweliskies to name a few. These indigenous tribes, and others, traveled up and down the Columbia River, utilizing shoreline areas within Wahkiakum County to forage, hunt, fish and for seasonal and permanent village sites. The Wahkiakums, one of the main tribes in the county maintained a village along the Elochoman Slough, near what today is the Town of Cathlamet.

3.6.13 Known Cultural and Historical Resources

The Washington State Department of Archaeology and Historic Preservation (WSDAHP) maintains data on recorded sites, buildings, historic districts and cemeteries within the state. Known and recorded sites within the County and Town can be found by accessing public information contained on the Washington Information System for Architectural and Archaeological Records Data (WISAARD) at https://fortress.wa.gov/dahp/wisaard/.

Chapter 4: WRIA 24 Willapa Bay

The majority of WRIA 24 is located in Grays Harbor and Pacific Counties and includes 754 rivers and streams with over 1,470 linear stream miles. The basin largely drains into Willapa Bay, and to a lesser extent, into the lower Columbia River both in Pacific County. A small portion of WRIA 24's Naselle River – Frontal Willapa Bay watershed is in Wahkiakum County including the upper reaches of Naselle River and Salmon Creek. Both of which provide varying degrees of suitable spawning and rearing habitat for salmon.

4.1 Naselle River – Frontal Willapa Bay Watershed

4.1.1 Physical and Biological Characterization

This small portion of the WRIA/HUC 10 watershed area within Wahkiakum County consists of approximately 2,275 acres in the Willapa Hills. The SMP jurisdictional shoreline covers approximately 230.26 acres, including 17 miles of Salmon Creek with a low to moderate gradient and 3.7 miles of the Naselle River, with low to moderate gradient. As described in the following sections and in Appendix A, shoreline of the state reaches in Wahkiakum County jurisdiction affected by the characteristics of this watershed include:

- NW_Naselle_01
- NW_Naselle_02
- NW_SalmonCreek_01
- NW_SalmonCreek_02
- NW_SalmonCreek_03

The SMP jurisdictional shoreline in the Naselle River watershed begins in the Willapa Hills. The Naselle River originates in Pacific County, north of Wahkiakum County. A relatively small section of the river enters the County in the northwest corner of the County boundary, loops around and exits the County, toward the town of Naselle in Pacific County. This area is sometimes referred to as the East Fork, and much of the mainstem is confined within a bedrock canyon.

Salmon Creek also begins in the Willapa Hills north of Wahkiakum County exiting the County and following State Route 4 until the confluence with the Naselle River in Pacific County near the town of Naselle. This tributary is just over 17 miles in length and has a low to moderate gradient. About 23 percent of the entire watershed basin (both in an out of the County) consists of basalt geology, capable of supplying good spawning gravels for salmon. (The Willapa Alliance 1998).

Forest and fish protection rules (Forest Practices Rules; WAC 222) (effective March 2000) have required increased stream buffer widths and limits timber removal in riparian areas. These requirements have improved the overall integrity of riparian corridors and streams. Impacts to stream temperature, large woody debris recruitment, and erosion, have been reduced (Pacific County (WRIA 24) Strategic Plan for Salmon Recovery, 2000).

Land cover in the Naselle watershed is dominated by upland coniferous forests followed next by disturbed or modified landscapes (see Table 4.1). Disturbed or modified landscapes primarily include recently logged landscapes and agriculture (See Map 47 in APPENDIX E). Salmon Creek Reach 2 contains the majority of the residential development. Agriculture occurs throughout all the reaches and occurs in the relatively narrow floodplain valleys in both stream systems in the watershed. Some smaller areas of deciduous forests, shrub and grasslands primarily occur in riparian areas. Riparian areas currently consist of about nine percent old growth, 47 percent mid-late seral stage forest, and 44 percent open, early conifer, or hardwood dominated forests (The Willapa Alliance 1998). Reaches along Salmon creek in Wahkiakum County are largely pasture/hay fields with intermittent areas of palustrine scrub/shrub wetlands and low-intensity development (mainly residential).

Table 4.1 Naselle Watershed Land Cover

Land Cover Class	Acres	Percent of Total Acreage in Watershed
Forest & Woodland	1061.70	46.70
Shrubland & Grassland	53.13	2.34
Agricultural Vegetation	44.68	1.97
Recently Disturbed or Modified	1110.39	48.84
Developed	3.78	0.17
Total	**2273.68**	**100.00**

Source: NLCD 2012

Hydrological issues within the watershed include low fluvial flow, particularly in the summer months when there is less precipitation. Washington Department of Fish and Wildlife recommended limiting the issuance of new water rights permits to allow adequate stream flow for salmonids and other fish species.

The upper Naselle River north of the County line is confined within a bedrock canyon. The stretch of river within the county opens up into a relatively narrow floodplain valley. This stretch of the river has a low to moderately steep gradient (Pacific County (WRIA 24) Strategic Salmon Recovery Plan 2000).

Wetlands

As previously described, wetlands are important to ecosystem processes and shoreline ecological functions. Associated wetlands in this watershed make up approximately 159 acres primarily located along the relatively narrow floodplains and riparian areas of Salmon Creek and the Naselle River. Wetlands consist of freshwater emergent and forested/shrub types. Table 4.2 summarizes the Associated Wetlands in the watershed by wetland type. Emergent wetlands make up almost 1.3 percent, where freshwater forested/shrub wetlands make up approximately 5.7 percent of the total wetlands in the watershed within Wahkiakum County. Almost all of these wetlands are Associated Wetlands within the floodplain and therefore are within the shoreline jurisdiction. These areas are currently identified and regulated as Critical Areas in the County (CREST 2006). See Appendix E Maps 1 and 24.

Table 4.2 Wetlands in Wahkiakum County portion of the Naselle Watershed

Associated Wetlands	Acres	percent Wetlands of total Watershed
Freshwater Emergent Wetland	28.60	1.26
Freshwater Forested/Shrub Wetland	130.40	5.73
Floodplain	188.37	8.28
Total Watershed Area	**2275.49**	

Source: NWI 2012, WBD BLM 2013

Aquifer recharge areas

Potential recharge areas in the Wahkiakum County portion of WRIA 24 include floodplain areas in and around the upper Naselle River, Salmon Creek and their tributaries. Most of the water and resource protection wells occur in these areas. See the Critical Areas Map (Map 14) in APPENDIX E.

Fish and Wildlife Habitat

The upper Naselle River and Salmon Creek in Wahkiakum County have been identified as Priority Habitat for Roosevelt elk *(Cervus Canadensis).* Additionally several salmonid species such as Fall (and other runs) Chinook (*Oncorhynchus tshawytscha*), chum (*Oncorhynchus keta*), steelhead (*Oncorhynchus mykiss*), migratory and spawning ground for coho (*Oncorhynchus kisutch*), and resident coastal cutthroat (*Oncorhynchus clarkii*) salmon and winter steelhead trout spawn in both the mainstem of Salmon Creek and Naselle River mainstem and tributaries (Pacific County (WRIA 24) Strategic Salmon Recovery Plan 2000). See salmonid distribution maps (Maps 28-41) in APPENDIX E. Additionally, marbled murrelet (*Brachyramphus marmoratus*) presence has been detected in the watershed in the past.

Much of the floodplain valley has been modified (i.e. diked, filled and graded for agricultural uses), which has impaired many ecosystem functions such as sediment movement, nutrient cycling, and habitat connections in the floodplain. See Figure 4.1. As a result there are depressional wetlands that exist in these areas that support species such as frogs and amphibians. Forestry and agriculture in this watershed has reduced riparian vegetation and cover. Elk may have benefitted from some of the pasture lands created by landowners in the region with edge cover existing in the upland forested areas. The entire Naselle Watershed has lost an estimated 18 acres of off-channel habitat, accounting for about two percent of the total historical level (Willapa Alliance 1998).

In-stream habitat generally supports salmonid spawning in the Naselle River, Salmon Creek and some of their tributaries. However, several limiting factors discussed in the section 4.2 below may reduce the quality of the functioning habitat. An example of this reduction in quality habitat is the recruitment of large woody debris (LWD) and pool habitat in stream and river systems. Surveys conducted by the Pacific County Conservation District (1997) found that 92 percent of the survey areas within the watershed did not met target levels of LWD. Lack of LWD in flashy systems such as the Naselle watershed, prevents the development of ripple-pool stream dynamics, reducing the habitat quality for salmonids and other fish species.

The watershed has been and continues to be actively logged. Marbled murrelet (*Brachyramphus marmoratus)* species prefer old-growth habitat for inland nesting sites. Due to current forest management activities, it is unlikely that the recruitment of additional suitable marbled murrelet habitat will occur within the managed forest landscape of the Naselle watershed.

Frequently flooded areas
According to FEMA/FIRM data (FEMA 2010), much of the floodplain areas on both the Naselle and Salmon Creek are considered "Special Flood Hazard Areas" or the land area covered by the floodwaters of the base flood and requires a mandatory purchase of flood insurance. All of the 188 acres of the Salmon Creek and Naselle River floodplain in Wahkiakum County are part of the one percent annual flood risk (100-yr floodplain) and are considered "flood hazard areas" (Table 4.2). Most of the SMP shoreline contains the floodplain. See the Preliminary Shoreline Jurisdiction map (Map 1) and Flood Risk maps (Maps 16 -18) in APPENDIX E.

Geologically hazardous areas
General slope and soil types in the area indicate that areas in around Salmon Creek are prone to landslide risk. The depth of soils before bedrock, slope, permeability, availability of water, effective rooting depth, rate of rapid runoff and hazard of water erosion are quantified to rate soils (CREST 2006). Some areas along the Naselle River have a moderate landslide risk according to a hazard landslide risk assessment completed by CREST (See landslide hazard risk map (Map 19) in APPENDIX E) (2006).

According to an assessment completed by CREST (2006), the floodplains of both the Naselle River and Salmon River are a moderate to high risk of susceptibility to liquefaction hazards. The site class map, first developed by CREST (2006) delineated areas based on potential for enhanced ground shaking and is based on regional geologic mapping based on geologic data from the Washington Department of Natural Resources.

4.1.2 Land Use and Shoreline Modifications

Typical land uses in the Naselle River Valley include forest land on the steeper slopes, and farming and residential areas located along the river valley. Some single-family development occurs within the watershed near Naselle River and Salmon Creek. Much of the area has been logged in the past. Logging operations still occur in and around the SMP jurisdiction. Logging infrastructure, such as roads, exist throughout the upland areas near these stream/river systems. Several small agricultural operations also occur along both the Naselle River and Salmon Creek, in and near the SMP jurisdiction. Table 4.3 below demonstrates the acreage and percentage of each type of land use in the Watershed within the boundaries of Wahkiakum County. See Land Use map (Map 52) in APPENDIX E for land use data from 2010.

Table 4.3 Naselle Watershed Land Use

Land Use	Acres	Percent of Total Acreage in Watershed
Agriculture	36.63	1.63
Forestry	1826.62	81.43
Government	0.145	0.01
Non Commercial Forestry	7.56	0.34
Open Space	139.72	6.23
Residential (Multi-Family)	23.26	1.04
Residential (Single-Family)	101.46	4.52
Undeveloped	107.81	4.81
Total	**2243.21**	**100**

Source: Ecology 2010

One of the main limiting factors to river morphology and habitat structure and function in the basin is the delivery of excess sediment to rivers and streams. The issue is the result of inadequately maintained roads. The Naselle watershed and surrounding areas has an average of 5 miles of road per square mile (The Willapa Alliance 1998). A solution to this issue could be regular maintenance or decommissioning of older roads, which can reduce the amount of sediment entering streams. New road construction should utilize the use of Best Management Practices (BMP's) such as straw wattles, rip rap pads, and filter fabric. These methods can dramatically decrease erosion (Pacific County (WRIA 24) Strategic Salmon Recovery Plan 2000, The Willapa Alliance 1998).

Forestry operations, logging road construction and use, single family development, grazing and some agriculture has resulted in downstream listed 303(d) impaired sections of the Naselle River in Pacific County. The density of riparian roads is high, about three miles of riparian roads per square mile of watershed, and this may account for additional losses beyond the conservative estimate of two percent habitat loss (The Willapa Alliance 1998).

The Salmon and Steelhead Habitat Limiting Factors in the Willapa basin report (Smith 1999) suggests that additional data is needed to understand the habitat features in Salmon Creek and Naselle River. The report identifies 21 culverts that obstruct anadromous passage throughout the entire watershed (including the part of the watershed in Wahkiakum County). Three of the culverts were listed as high impact, one medium impact, and the remainder as low impact.

Log jam removal occurred on Salmon Creek in the 1970's. LWD removal has resulted in some degree of channel scouring, physical injury to fish and eggs during water releases, channel incision, and decreased stability of gravel substrate in both subbasins.

4.1.3 Public Access Opportunities

The only existing public access opportunity that has been identified in this portion of the watershed is Salmon Creek Roadside Park managed by Wahkiakum County. The park is unimproved, allows for some overnight camping and is located between SR4 Mileposts eight and seven, about three miles west of Deep River. Additionally, some view-only opportunities exist along Salmon Creek Road, particularly at places where the creek intersects with the road.

Much of the landscape in the watershed is private forestry land and residences surround the waterways limiting public access opportunities. Some DNR managed state forestry land exists between Salmon Creek and the Naselle River and is open for public accesshowever, the access is not within the shoreline jurisdiction. Further discussion of existing and potential public access opportunities are described in Section 6.1.3. Existing public access areas can be viewed in APPENDIX E (Map 56)

4.1.4 Protection and Restoration Potential

The ecosystem-wide analysis described in Section 2.3 utilized available data to evaluate identified ecosystem-wide processes. APPENDIX D shows the data used to evaluate processes and impairments throughout the County. Using a suitability model, two maps were produced to show 1.) "Important Areas" based on a summarized combination of ecosystem data and 2.) "Impaired Areas" based on a summarized combination of data that identifies ecosystem impairments.

In the Naselle River basin, jurisdictional areas in the Map 61 in APPENDIX E (Mapfolio) could be further evaluated because these areas serve a variety of important ecosystem functions including sediment transport, nutrient cycling, wildlife habitat, surface water storage in wetland areas in the floodplain, much of which has been converted to agricultural and/or rural residential use, particularly along Salmon Creek (see Table 2in APPENDIX D). "Impaired Areas" were compared to higher ranked "Important Areas". "Impaired areas" that overlapped with "Important Areas" should be further evaluated for potential restoration opportunities in order to restore higher ranked "Important Areas". See Figure 4.2. Several areas in the watershed are considered to be highly impaired. This suggests that the ecosystem structure and function has been diminished, preventing or weakening ecosystem processes. See table and maps in APPENDIX D. Additionally, the reach matrix (APPENDIX A) identifies management issues including upland forestry, agriculture and amount of impervious surface near the stream systems contributing to watershed ecosystem process impairments. These limiting factors and management options for these issues are described below in Section 4.2.

Several locations in the watershed within Wahkiakum County have a rating of "high importance" as well as having "moderate" to "high" impaired areas and are therefore prioritized for restoration to improve the landscape processes that support healthy shoreline functions. Much of the impacts in this area are the result of impervious development, including roads relative to waterways as well as agricultural development. According to the Ecosystem Analysis map of impaired areas (Figure 4.1), several ecosystem functions such as wildlife habitat, surface storage, and overall functions that maintain water quality and sediment transport are moderately impacted along all reaches of Salmon Creek due to an increase in impervious surfaces, loss of depressional wetlands and riparian forest cover.

Additionally, instream and riparian areas in both the Naselle River and Salmon Creek reaches generally have some impairments, but have been identified as areas in need of Protection/Restoration, indicating that the reaches serve important ecological functions and may or may not have be impaired. Areas with higher impaired areas are generally associated with roads, including commercial and residential development that benefit from the existence of roads. A review of aerial imagery indicates that riparian areas are largely intact immediately adjacent to these waterways and do not contain instream impairments. However, agriculture and rural residential housing is prevalent, particularly along the Naselle River. Considering the existence of agriculture and low-intensity residential housing in the watershed, management and protection of the shorelines should balance the preservation of ecosystem processes, while protecting land use types in the region (i.e. agricultural production). The reach matrix (APPENDIX A) also lists each focus area type (results from the ecosystem-wide analysis) within reach in WRIA 24.

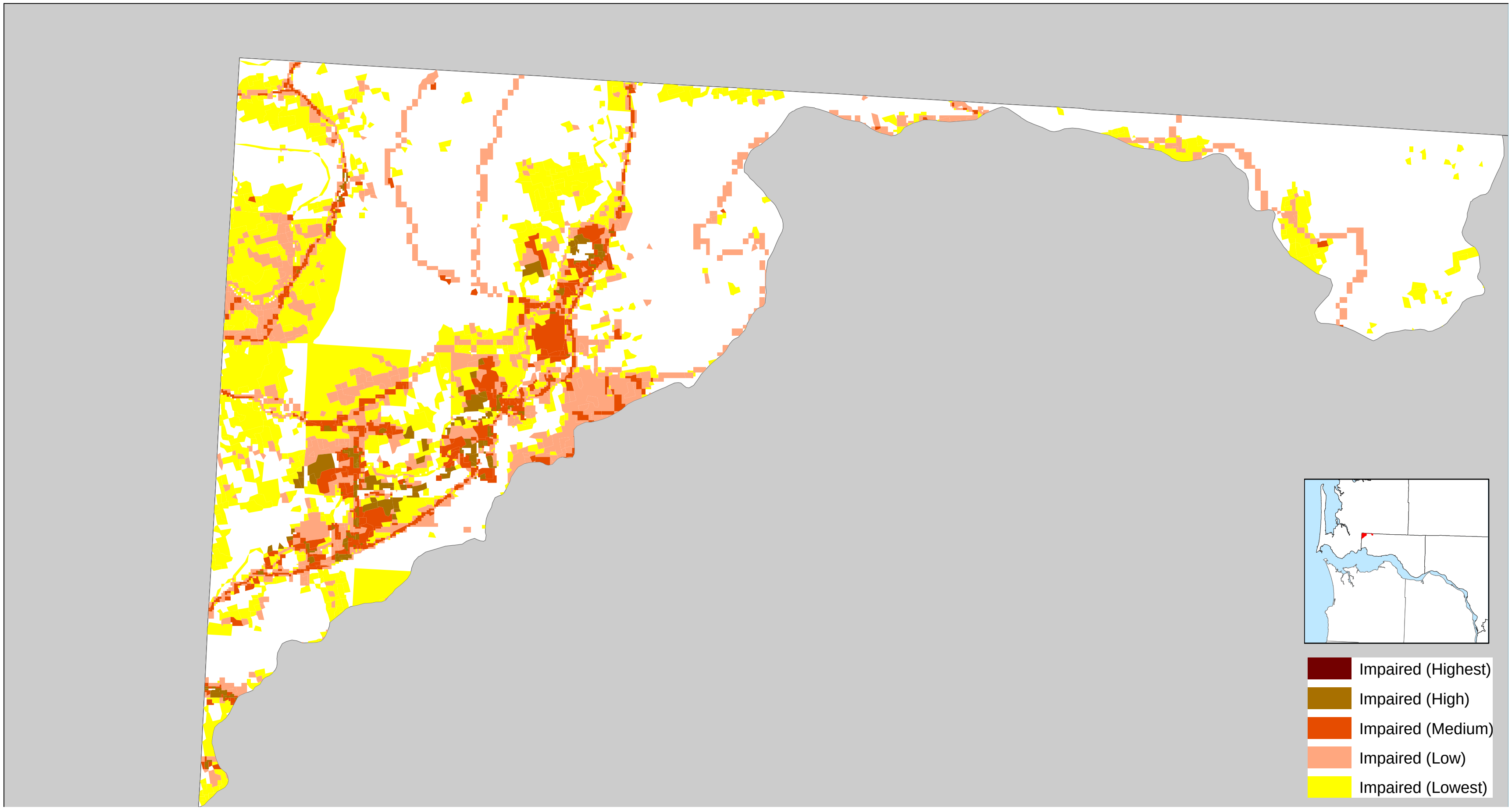


Figure 4.1 Naselle Watershed Ecosystem Analysis (Impaired Areas)

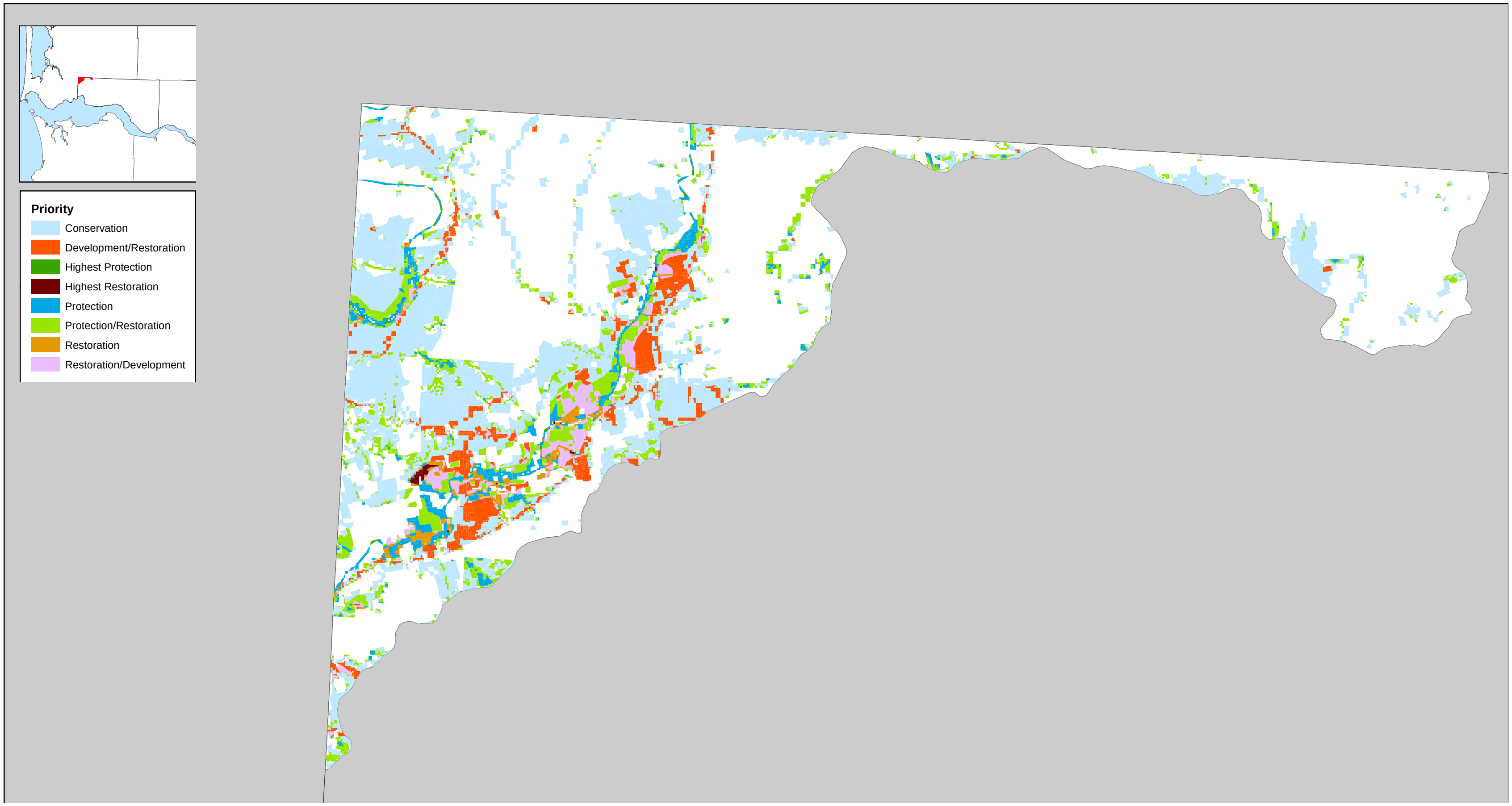


Figure 4.2 Naselle Watershed Ecosystem Analysis (Important Areas)

4.2 Key Management Issues and Opportunities

Impairments that affect ecosystem process, structure and function in Salmon Creek, the Naselle River and more broadly in WRIA 24 are identified below. These factors are impairment indicators of ecosystem functions and process health. These factors include:

General limiting factors in WRIA 24 as a whole:

Road Building

- Increases runoff
- Historic loss of riparian habitat (reduced shade, increases temperature, affects stream nutrient inputs)
- Increased fine sediment inputs
- Increased mass wasting (erosion, landslides)
- Culverts, tide gates and blockages (logs, debris plugging)

Logging

- Road construction
- Historic loss of riparian habitat (reduced shade, increases temperature)
- Increased fine sediment inputs
- Increased mass wasting (landslides)

Agriculture

- Loss of riparian habitat (reduced shade, increases temperature and changes nutrient inputs)
- Increased fine sediment inputs

Limiting factors specific to Salmon Creek include:

- Flood plain conditions are poor due to dikes and channel incision
- Low levels of spawning gravel
- Low levels of LWD and low likelihood of recruitment
- High road density in basin
- High water temperatures

Limiting factors specific to the Naselle River include:

- Low levels of LWD and near-term recruitment
- Riparian conditions and riparian road construction
- Sedimentation stemming primarily from a large number of landslides and secondarily from roads.

Riparian Condition

Agricultural operations, historic forestry practices, residential development and road construction have all contributed to the degradation of riparian zones. The lack of riparian vegetation in some of the narrow floodplains contributes to water quality issues related to temperature, as well as to increased sedimentation and a decrease in LWD potential.

Sedimentation, Bank Erosion, Bank Stability

The most significant streambed/sediment problems in the Naselle watershed include excessive sedimentation and low levels of LWD (Smith 1999 and CREST 2006). The greatest sources of sedimentation are from roads and mass wasting sites. Road densities of greater than three miles/square mile of watershed were rated as “not properly functioning” by the NMFS (NMFS 1995). The road density in the Naselle watershed is high, about 5.2 miles of roads/square miles of watershed (The Willapa Alliance 1998). Mid-slope roads pose the greatest risk of fine sediment release into the waterway. Coarse sediment builds up in the mainstem near the mouth of Salmon Creek. Road stream crossings are the highest in the WRIA with 20 crossings per square mile or 327 crossings on Type one – four streams, and riparian roads account for three miles of roads/square mile of watershed (The Willapa Alliance 1998). The density of roads has reduced forest vegetation in riparian areas, supply sediment, and in several places, act as dikes where roads are close to the stream (i.e. contributing to scour and channel instability (Smith 1999)

Large Woody Debris/Pool Habitat
LWD was found to be low in sampled areas, but is essential for good gravel storage capabilities in order to maintain salmonid spawning habitat (Smith 1999). According to the report, about 92 percent of the sampled areas did not meet target levels of functional LWD pieces, and about 66 percent of the sampled areas did not meet target levels for key LWD pieces (PCD Salmon Habitat Survey 1997; The Willapa Alliance 1998; Smith 1999). Restoring LWD pieces near sources of spawning gravel inputs would benefit habitat for a variety of species in the Naselle basin, but care should be taken with LWD to engineer large pieces preferably with root wads. Additionally, opportunities for sustained recruitment of LWD in the watershed should be evaluated for restoration potential.

Floodplain Connectivity
Floodplain connectivity in the Naselle and Salmon Creek reaches in Wahkiakum County has not been an issue identified in existing literature. However agriculture and the presence of residential development and impervious roads in the area establish barriers and/or channel constrictions with little or no access to adjacent floodplains. While little or no dike construction has been identified by existing data, the waterways are enclosed in relatively narrow valleys or entrenched in the streambed. As a result, limited connectivity causes a decrease in floodplain surface water storage, food web connections, nutrient cycling, natural sediment movement and an increase in channel confinement.

Water Quality
Water quality is an issue within WRIA 24 in Wahkiakum County. Lower areas of both the Naselle River and Salmon Creek not in Wahkiakum County have reaches listed as 303(d) streams primarily due to high temperatures. There is a moderate amount of impervious surface (roads and residential development as well as a large amount of logging activity in the uplands and near the shoreline that may contribute to sedimentation downstream and increased instream temperatures. See Water Quality map (Maps 23) in APPENDIX E.

Fish Access and Water Quantity
The ratio of fish barriers/blockages per stream mile in the basin is the second highest in WRIA 24. Roads contribute high sediment levels, loss of off-channel rearing habitat, and reduction of available riparian forest vegetation. Road decommissioning or maintenance could improve them to reduce slope failure. Roads that cross streams or lie within the floodplain are a particular hazard. Culvert and tidegate removal/replacement in the lower Naselle (in Pacific County) could provide improved fish access in the upper reaches (Pacific County Strategic Salmon Recovery Plan 2001).

Management Opportunities

The Naselle River-Frontal Willapa Bay HUC 10 watershed section in this Chapter has its own discussion about restoration and protection potential based on past reports discussed in each HUC 10 watershed section and the Ecosystem-wide analysis completed for Wahkiakum County and Town of Cathlamet. Refer to Table 4.4 below for potential management options. Recommendations in Table 4.4 are based on the Ecosystem-wide process analysis discussed in Section 2.3. Management issues and recommendations are also listed on a reach by reach basis in APPENDIX A.

In summary, Salmon Creek has the most development (impaired areas) and has more places in each of the three reaches needing restoration due to impervious development, agriculture and forestry than the Naselle River reaches. However, overall, between the two SMA streams, both have many areas in all of the reaches identified as priorities for protection and conservation actions to preserve existing ecosystem processes/functions. Figure 4.1 and 4.2 show the impaired and important areas, respectively. The analysis described in Appendix D suggests that much of the shoreline along the Naselle River is relatively unimpaired and that existing ecosystem processes, such as sediment movement, contribute to the current conditions, therefore management options should focus on protecting both those processes and shoreline functions. Much more development and agriculture occur along Salmon Creek. As a result, therefore, some of these areas are moderately impaired. This analysis suggests that these areas be further evaluated for restoration action, or conservation actions to prevent further impairment.

Table 4.4 Recommendations and Potential Management Options for the Wahkiakum County portion of the Naselle Watershed

General Recommendations	Ecosystem Processes Affected	Potential Management Options
Protection High Process Importance Low impairment areas	Surface water storage, surface erosion, mass wasting, in-channel erosion	Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and prohibiting bank hardening
	LWD movement, in-channel and surface erosion, sediment storage	Limit/avoid no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities
	LWD movement (unconfined channels, mass wasting areas, riparian tree cover, low-gradient channels)	Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones
	LWD movement (unconfined channels, mass wasting areas, riparian tree cover, low-gradient channels)	Discourage the removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities

General Recommendations	Ecosystem Processes Affected	Potential Management Options
	Surface water movement, sediment storage, nitrification, denitrification, toxin/metals adsorption	Develop a planning strategy that maintains ecological function that may including the possibility of minimizing development in the floodplain. Make sure setback restrictions are adhered to.
	All ecosystem processes	Continued protection of critical areas within shoreline jurisdiction
	Surface water storage/movement, recharge, surface erosion,, mass wasting , in-channel Erosion	Maintain the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients
	Surface water storage, LWD inputs, groundwater flow, mass wasting,(de)nitrification, toxins and metals adsorption	Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas
	(de)nitrification, pathogen movement, toxin/metal adsorption	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer
	Groundwater recharge, pathogen movement, toxins adsorption	Maintain septic systems
	(de)nitrification, pathogen movement, toxin/metal adsorption, LWD movement, surface erosion, surface water storage, sediment storage	Maintain native riparian vegetation
	LWD movement, in-channel and surface erosion, sediment storage, surface water storage/recharge	Discourage new shoreline armoring in these areas
Conservation High Process Importance Low impairment areas	All ecosystem processes	Continued protection of critical areas within shoreline jurisdiction

General Recommendations	Ecosystem Processes Affected	Potential Management Options
	Surface water storage, surface erosion, mass wasting, in-channel erosion	Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening
	LWD movement, in-channel and surface erosion, sediment storage	Avoid/limit new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities or increasing habitat through bioengineered restoration
	LWD movement(unconfined channels, low-gradient channels, riparian tree cover), surface erosion, surface water storage, groundwater recharge	Discourage new dwelling units or expansion of existing structures within the CMZ
	LWD movement (unconfined channels, mass wasting areas, riparian tree cover, low-gradient channels)	Avoid/limit development and shoreline modifications that would result in interference with the process of channel migration that may result in a net loss of ecological functions associated with the rivers and streams
	LWD (unconfined channels, mass wasting areas, riparian tree cover, low-gradient channels)	Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones
	LWD (unconfined channels, mass wasting areas, riparian tree cover, low-gradient channels)	Prohibit removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities
	(De)nitrification, pathogen movement, toxin/metal adsorption	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer

General Recommendations	Ecosystem Processes Affected	Potential Management Options
	All ecosystem processes	Limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation
	Surface water storage, nutrient cycling, sediment movement, surface erosion, in-channel erosion	Avoid, where possible, the construction of new dikes, levees, tide-gates, floodgates, pump stations, culverts, dams, water diversions, and other alterations to the floodplain, except for habitat improvements such as a wider culvert for fish passage
	Surface water storage, nutrient cycling, sediment movement and storage, in-channel erosion	Avoid new road construction at stream and wetland crossings
	LWD movement, mass wasting, surface erosion, toxin and pathogen movement, (de)nitrification	Maintain vegetation, limit disturbed areas, and control drainage on steep slopes.
	surface water storage and movement, LWD inputs	Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible
	All ecosystem processes	Increase opportunities for land exchanges that retain or restore floodplain and delta habitats
	Surface water storage, LWD inputs, groundwater flow, mass wasting,(de)nitrification, toxins and metals adsorption	Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas
	Mass wasting, sediment storage, surface erosion, in-channel erosion	Minimize and control runoff and soil erosion
	(de)nitrification, pathogen movement, toxin/metal adsorption, LWD movement, surface erosion, surface water storage, sediment storage	Maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting

General Recommendations	Ecosystem Processes Affected	Potential Management Options
Restoration High process importance, Higher impairment areas	All ecosystem processes	Limit impervious areas
	Groundwater recharge, pathogen movement, toxins adsorption	Repair faulty septic systems
	(de)nitrification, pathogen movement, toxin/metal adsorption	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer
	All ecosystem processes	Coordinate restoration plans with salmonid recovery and watershed management plans, water clean-up plans for TMDLs, stormwater management programs, and with stormwater basin plans where they have been developed
	Surface water movement/storage, groundwater recharge and flow, sediment storage, surface erosion, mass wasting	Restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients
	All ecosystem processes	Restore natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening
	All ecosystem processes	Plan for and facilitate removal of artificial restrictions to natural channel migration, restoration of off channel hydrological connections and return river processes to a more natural state where feasible and appropriate
	All ecosystem processes	Restore natural channel morphology
	All ecosystem processes	Increase opportunities for land exchanges that retain or restore floodplain and delta habitats
	All ecosystem processes	Encourage the removal or relocation of structures within the channel migration zone to facilitate the natural recovery of channel migration processes

General Recommendations	Ecosystem Processes Affected	Potential Management Options
	Surface water movement/storage, groundwater recharge and flow, sediment storage, surface erosion, mass wasting	Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates
	surface water storage and movement, LWD inputs	Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible
	Surface water storage, sediment storage, surface erosion,	Support the removal and control of noxious weeds
	All ecosystem processes	Maintain native riparian vegetation and encourage the restoration of degraded riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting.
	Mass wasting, sediment storage, surface erosion	Close unnecessary roads
	Mass wasting, sediment storage, surface erosion	Minimize and control runoff and soil erosion
	All ecosystem processes	limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation

General Recommendations	Ecosystem Processes Affected	Potential Management Options
Development Low water process importance, Moderate/Higher impairment areas	All ecosystem processes	limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation.

4.3 Data Gaps

Information for this WRIA was gathered largely from analysis performed for this inventory and characterization report. In general, upper reaches appear to be under studied in terms of hydrologic, land use, land cover and habitat conditions. Overall, data available for some watersheds was more abundant than others and while the report attempts to keep the report consistent in terms of what data is presentated, this is not always possible both in this chapter and chapter 5. For example, Grays and the Elochoman rivers have more data on hydraulics and ecosystem structure. As a result, overall management recommendations are more specific in these areas because the issues are better known.

The ecosystem process analysis (see Appendix D) has several areas where some data was not available for the analysis (highlighted in yellow in Appendix D). The unavailable data includes: data used to identify areas with nitrification issues, upland areas with clay soils used to determine areas of movement via adsorption (T), depositional stream channels and channel gradients (originally provided in data from WDFW that is no longer available). Unavailable data may have impacted the results of the Ecosystem-Process Analysis used to identify impacted and important areas. However, most of the data for the analysis was available and some assumptions regarding areas for development, conservation, protection and restoration can generally be viewed as a starting point for further investigation.

Additionally there were some underlying assumptions from Stanley et al. (2012) regarding the analysis, which field verification may be necessary on a project by project basis. These assumptions include:

9.) In general, topography, the shape or geometry of the aquifer system, and the locations and amount of discharge and recharge control the movement of the uppermost layers of groundwater (Vaccaro et al. 1998).

10.) In general, groundwater flow follows major topographic gradients. Groundwater movement will tend to be from higher areas to lower areas (Vaccaro et al. 1998). LFlows in Wahkiakum County are generally surface water drainages.

11.) On slopes of less permeable geology, water will move downslope as subsurface flow. If it reaches more permeable deposits when the topography flattens, this water will then move downward to recharge groundwater.

12.) Lakes and large wetland areas (if not on perched water tables) and perennial streams are an expression of the water table or the emergence of groundwater at the surface.

13.) Alluvium and recessional outwash are generally of high permeability.

14.) Till, moraines, organic deposits, lacustrine, glacial marine drift, mudflows, fine alluvium, and bedrock are generally of low permeability.

15.) Advanced outwash can be of moderate permeability, but it may be locally overridden with glacial till (advanced outwash was deposited in front of the glacier and was often subsequently covered with glacial ice). In this instance, permeability should be low since the till layer intercepts percolating water first.

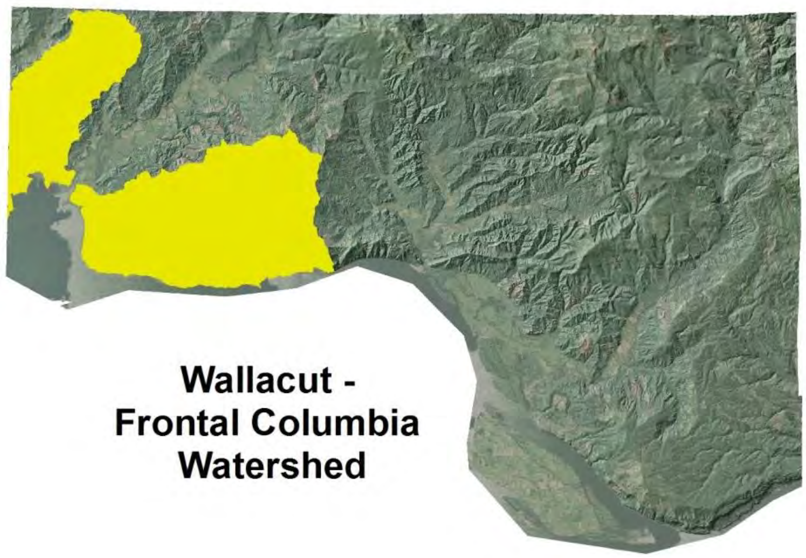
16.) Areas of glacial marine drift are sometimes included within areas mapped as glacial outwash.

Chapter 5: WRIA 25 Grays – Elochoman

WRIA 25 occupies approximately 296,000 acres mostly in Wahkiakum and Cowlitz Counties. The WRIA drains into the lower Columbia River. The topography varies and as a result, microclimates and the hydrologic features vary accordingly. Generally speaking, the basins in the WRIA change from narrow canyons of the Willapa Hills in the upper reaches to relatively broad stretches of floodplains and terrace features. The HUC 10 watersheds in this Chapter include the following, listed from west to east, and are further discussed in the sections below:

- Wallacut River – Frontal Columbia River
- Grays River – Frontal Columbia River
- Baker Bay – Columbia River
- Elochoman River – Frontal Columbia River
- Cathlamet Channel – Columbia River
- Germany Creek – Frontal Columbia River

5.1 Wallacut River – Frontal Columbia River



5.1.1 Physical and Biological Characterization

The Wallacut River – Frontal Columbia River watershed consists of approximately 25,530 acres split between two primary drainages, the Deep River to the west and the Crooked Creek to the east.. The watershed is divided in half by the Grays Bay watershed described separately later in this chapter. The SMP jurisdiction covers 1192.94 acres of shoreline with approximately 81,636 linear feet (15.5 miles) of SMP jurisdictional streams. Streams/rivers designated as "shorelines of the state" include:

- Sisson Creek (WFC_Reach 1)
- Deep River (WFC_Reaches 1 – 9)
- Rangila Slough (WFC_Reach 1)
- Halaya Slough (WFC_Reach 1)Crooked Creek (WFC_ Reaches 1 – 3)
- Jim Crow Creek (WFC_Reaches 1 – 3)
- Artificial Path_02??

All floodplain, riparian, and upland SMA jurisdictional areas immediately adjacent to the Columbia River within the Wallacut Watershed are summarized and described in the Baker Bay Watershed (Section 5.2) since the resources, land use, and any impairments directly affect the Columbia River (Baker Bay watershed). Many tributaries within the watershed drain into these waterways. While these tributaries do not qualify for consideration as "shorelines of the state", most of these tributaries qualify as critical areas pursuant to the County's CAO. Additionally, Crooked Creek and its tributaries are often categorized in the Grays Bay/Grays River watershed. However, the

National Hydrological Dataset (2012) includes Crooked Creek in the HUC 10 Wallacut – Frontal Columbia River watershed and is represented as such in this report.

The general slope in the Crooked Creek and Deep River basins containing shorelines of the state is low to moderate in the upper reaches and decreases as the rivers flow downstream and the floodplain valley opens up as each river empties into the Columbia River. Deep River is a relatively slow moving river that is largely diked on both sides of the river, particularly in the lower reaches of the river. Pasture and hay for relatively small livestock operations are the primary land use and the dominant land cover in the floodplains. A few of the lower floodplains have limited access to tidal influences due to the construction of levees and other water control structures..

In the Jim Crow Creek drainage, the basin is characterized by steeper slopes that enclose the creek in relatively steep hillsides/canyons. It is estimated that the mean annual flow is 23,790 acre*feet/year (32.86 cfs). Jim Crow Creek's stream gradient is considered high to moderate in the upper reaches and tapers to a moderate gradient as it enters the Columbia River. As water moves down the creek, the steep slopes open up and small non-tidal forested floodplains have developed in these areas. The mouth of Jim Crow Creek has steep wooded banks with rocky shoreline. The Jim Crow Creek generally has good bank stability conditions (LCFRB 2010a).

The shorelines of these drainage systems are impacted by tidal influences. Tidal influence affects the entire extent of the SMA stream length in Deep River. In Jim Crow Creek, the tidal influence extent ends just upstream of the South Creek confluence. A map showing the approximate 'head of tide' tidal extent (Map 17) in the SMA streams in Wahkiakum County can be viewed in APPENDIX E. Tidal influences in these river systems form backwater sloughs within the floodplain over time. River basins with gentle slope gradients and a tidal influence may form sloughs. Several sloughs (mentioned above) meet the "shorelines of the state" criteria. These tidal sloughs occur in the lower reaches of Deep River

Table 5.1 is representative of this HUC 10 watershed as a whole. Land cover of the shorelines and surrounding area of Deep River is dominated by agriculture and herbaceous wetlands in the floodplains. Historically, the area would have been dominated by tidally influenced shrub/scrub and herbaceous wetlands, but much of the floodplain has been cut off from Deep River due to the construction of levees. (Appendix E Map 49)

Crooked and Jim Crow Creek are both dominated by coniferous and deciduous upland and deciduous wetland cover. In lower Crooked Creek, there are some tidally influenced deciduous wetlands and shrub and herbaceous wetland cover. See Map 42 in APPENDIX E). Land cover in the lower Crooked Creek basin is dominated by agriculture with some herbaceous and scrub/shrub cover types in the tidally influenced areas. Jim Crow Creek is surrounded by narrow and steep terrain and there is little to no floodplain for much of the waterway. Dominant land cover types are similar to the dominant land cover types across the entire watershed (coniferous forests in the upland and deciduous woodland forests in the riparian areas. See Table 5.1 below for a summary of land cover by acres in the watershed. The low number of acres in development is a product of the relatively slow growth this area has experienced over the last decade as well as the agricultural and forestry production as the primary economic driver in the region.

Table 5.1 Wallacut watershed land cover

Land Cover Type	Acres	percent
Agriculture	2500.88	9.80
Aquatic Vegetation	2.45	0.01
Developed	52.02	0.20
Forest and Woodland	15807.09	61.92
Nonvascular & Sparse Vascular Rock Vegetation	0.00	0.00
Open Water	302.11	1.18
Recently Disturbed or Modified	6284.64	24.62
Shrubland & Grassland	577.76	2.26
Total	**25526.93**	**100**

Source: NLCD 2012

Wetlands and floodplains

The structure and function of wetlands play an important role in the ecosystem processes that contribute to the Wallacut River basin, Baker Bay – Columbia River, which Deep River and Crooked Creek flow into and the greater Columbia River Estuary.

Historical wetlands along the shorelines in this watershed were dominated by tidally influenced herbaceous, shrub and deciduous wetlands within the floodplain. These wetland types have been significantly reduced by the construction of levees, water control structures and the advent of agricultural practices in the floodplain, particularly on Deep River. This has affected ecosystem-wide processes such as nutrient cycling, river and stream hydraulics and historic habitat structure Although floodplain connectivity in the Jim Crow Creek basin is considered to be in good condition (Wade 2002). Currently, six percent of the watershed area in Wahkiakum County consists of emergent wetlands and seven percent (1792 acres) is forested and shrub wetlands (See Table 5.2). While a large percentage of emergent wetlands exist in the basin, only a small amount of the emergent wetlands is tidally influenced. The reduction in the existence of tidally influenced emergent wetlands is due to the water and flood control activities in the watershed. Table 5.2 summarizes wetland and floodplain areas in the entire HUC 10 watershed.

Many of the wetlands in this watershed are in the floodplain areas and, based on aerial photography and elevation data (DEMs and LiDAR) seem to be hydrologically connected to the overall watershed/drainage system. However, further field verification may be necessary to understand the realized hydrological connection. Intertidal wetlands are limited in this watershed as Deep River has largely been modified. Although some relatively intact intertidal wetlands still occur. One example is at the mouth of Crooked Creek.

Table 5.2 Wetlands in Wallacut watershed

Associated Wetlands	Acres	Percent Wetlands of total Watershed
Freshwater Emergent Wetland	1571.87	6.15
Freshwater Forested/Shrub Wetland	1791.62	7.01
Freshwater Pond	18.99	0.07
Floodplain	2106.66	8.24
Total Watershed Area	**25553.99**	N/A

Source: NWI 2012, WBD BLM 2013

Aquifer recharge areas

The most productive yields within the Deep River and Crooked Creek occur in/on the unconsolidated to poorly consolidated sediments of the Alluvium and Older Alluvium units (Weigle and Foxworthy, 1962; Myers 1970; WADOE 1972; Sweet and Edwards 1983; Piechowski and Krautkramer, 1998) that occur within the major river and stream valleys. Most wells in WRIAs 25, particularly along Deep River, with high groundwater yields (300 to greater than 3,000 gpm) are completed within these units.

The hydraulic characteristics of the unconsolidated to poorly consolidated sediments of the alluvium and older alluvium deposits are highly variable and dependent on the geologic source of the sediments, mode of deposition, and thickness (LCFRB 2001).

The Critical Areas map (Map 14) in APPENDIX E shows likely areas where aquifer recharge areas occur. In this watershed, aquifer recharge areas occur on geological units that are known for having a high to moderate rate of permeability. Other important areas, such as wetlands, streams, and water and resource protection well information, are also used to identify potential recharge areas. The Deep River and Crooked Creek channel, the 100-yr floodplain areas and tributaries to these waterways are likely areas for aquifer recharge. Most wells occur along Deep River in the floodplain.

Fish and Wildlife Habitat

WDFW has identified priority habitat areas for a number of species in the watershed (See the Priority Habitat map (Map 26) in APPENDIX E). Washington State Priority Habitats in this watershed have been identified for Elk. Heavy waterfowl, cavity-nesting ducks and shorebird concentrations utilize Baker Bay as well as the mouth and lower reach of Deep River. The mouth of Crooked Creek also is home to concentrations of waterfowl and cavity-nesting ducks. This area also contains old growth/mature forests. The upper reaches of Deep River have been identified as marbled murrelet (*Brachyramphus marmoratus*) habitat. Bald eagles are also known to utilize areas where these river/creek systems empty into the Columbia.

Historically, local wild salmonid stocks included fall Chinook (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), sea-run cutthroat trout (*Oncorhynchus clarki clarki*) and steelhead trout (*Oncorhynchus mykiss*) were abundant in parts of the watershed (Deep River basin and Crooked Creek) (Tetra Tech, Inc., Entrix, Inc. and Waterfall Engineering, LLC 2009). All 13 listed Columbia River Salmonid Evolutionary Significant Units (ESUs) and Pacific eulachon (*Thaleichthys pacificus*) and green sturgeon (southern DPS) have been known to utilize the tidal reaches of the river and stream systems in the watershed. Many of these populations have faced significant declines within the watershed resulting in the federal ESA listing of several of these salmonid species. See salmonid distribution map (Maps 28-41) in APPENDIX E.

Aerial photo analysis and the CREST limiting factors analysis (2006) has shown that upper Deep River does have some deposits of large woody debris. However, much of the forested floodplain has been converted to agriculture in these reaches. Lower Deep River lacks the availability of forested riparian habitat and does not have much visible Large Woody Debris. Deep River has an overall “poor” large woody debris rating (CREST 2006). Crooked Creek, similar to Deep River is largely Agriculture and herbaceous wetlands in the floodplain. Much of the stretch of the creek in the shoreline jurisdiction has a “poor” rating for LWD recruitment; however, some sparse LWD does occur in the creek. Jim Crow Creek, despite have more LWD present in the creek, still has a “poor” rating. This is due to roads and heaving logging in the upper watershed, limiting riparian and upland logs from entering the creek system.

Additionally, pool habitat is considered poor in Jim Crow basin. The few good pools were associated with beaver activity and the delivery of small diameter wood (LCFRB 2010a). The majority (67 percent) of surveyed reaches (WCD surveys) on Jim Crow Creek rated poor for substrate fines (>17 percent fines <0.85 mm) (LCFRB 2010a).

According to a limiting factors analysis completed by CREST (2006) (Map 63 in APPENDIX E), riparian habitat in Deep River, Crooked Creek, and Jim Crow Creek have all largely been rated as being of “poor” quality. Some areas in the two creeks (primarily the upper tributaries) have both a “fair” and “good” rating.

For the Jim Crow Creek basin, 94.5 percent of surveyed riparian areas are in “poor” condition. Most of the basin is commercial and state timberland and were heavily harvested in the mid-20th century (Waterstrat 1994). In most cases, poor riparian areas are found in the lower river segments due to the impacts of agriculture, livestock grazing, roads, and diking on buffer widths and species composition. Riparian areas provide a variety of ecosystem functions which are created by ecosystem processes, such as channel migration, erosion and accretion. Riparian areas in poor conditions are unable to provide the structure (vegetation communities) and/or function (water quality, debris inputs, food web connects, habitat, etc.). Riparian areas are exclusively located along shorelines and are essential to the health of a functioning stream and/or river ecosystem. Upper reaches tend to suffer from young timber stands, and to a lesser extent, high deciduous composition. Poor riparian conditions in the Wallacut watershed have also been attributed to mass wasting and debris flows (DNR 1996 and LCFRB 2010a).

Additionally, Wahkiakum County Conservation District (WCD) surveys rated 97 percent of the Jim Crow watershed as poor for LWD (<0.2 pieces/meter). Some woody debris was found in middle valley reaches but it was of small diameter. Most delivery was believed to occur through windfall. (LCFRB 2010a).

Much of the historical floodplains in the Deep River basin have been leveed. This system of levees provides flood control and limits tidal access to the floodplain. This has reduced the connection and important habitats that salmonids and other fish species have utilized for foraging and rearing habitat. Thomas (1983) evaluated habitat change in the Columbia Estuary. He estimated that the Columbia River Estuary contained approximately 46,200 acres of tidal swamps and marshes. This figure was reduced to 16,150 acres in 1983 (a 65 percent decrease). Floodplains that do have access to the river are usually controlled by tide gates and culverts, which also limit fish access to potential habitat.

The development of water control structures has also created depressional wetlands that would have historically had surface connection to waterways. These wetlands host a variety of species such as salamanders and frogs. Riparian areas above the head of tide are also likely to provide habitat for a variety of amphibian, reptile and mammalian species.

Frequently flooded areas
According to FEMA/FIRM data (FEMA 2010), much of the floodplain areas in Deep River, Crooked Creek and lower Jim Crow Creek are considered "Special Flood Hazard Areas". Most of Deep River and Crooked Creek, under SMP jurisdiction, qualify as being under the 1 percent annual flood risk (100-yr floodplain) and are considered "flood hazard areas". As mentioned above, a large portion of Deep River, on both sides of the river, are diked, particularly where the floodplain was inundated by the tide. Jim Crow Creek has a relatively small floodplain that is increasingly small in upper reaches. These narrow floodplains are all considered "flood hazard areas".

Geologically hazardous areas
The floodplains along Deep River and Crooked Creek create some separation between the waterway and "landslide hazard areas" located primarily on the surrounding steeper terrain. The floodplains in Deep River and Crooked Creek create a landslide hazard buffer. However, the upper reaches get closer and closer to landslide hazard areas as the steeper terrain closes in on the river and creek. Outside of the shoreline jurisdiction, topographically diverse areas have some moderate "landslide hazard risk". The majority of Jim Crow Creek SMP shoreline is located in the relatively narrow floodplain. However there are several areas with moderated to high land slide risk, particularly in the upper reach and near the mouth (Landslide hazard map (Map 19) in APPENDIX E).

Additionally, highly erodible soils combined with ground disturbing activities, particularly in the middle subbasins of Deep River, Crooked Creek, Jim Crow Creek and their tributaries can result in slope failures along the shorelines. Common ground disturbing activities in the Grays Bay watershed include logging and road-building (WCFHMP 2006).

Low-lying areas such as floodplains and wetlands generally have a higher risk of liquefaction hazards. Much of Deep River, it's SMA tributaries and Crooked Creek are highly susceptible to liquefaction hazards in the floodplain areas (see Liquefaction Hazard Map (Map 21) in APPENDIX E) (CREST 2006). Lower Jim Crow Creek also has a high probability of liquefaction hazard risk. However, the gradient in Jim Crow Creek quickly becomes steep and narrow and as a result has a moderate and high rating for landslide hazards.

5.1.2 Land Use and Shoreline Modifications

Overall land use in the watershed is summarized in Table 5.3. Land use in the watershed is dominated by forestry at 88.23 percent followed by agricultural production. The amount of development in the region reflects the amount of undeveloped land needed to sustain these economies. The development that does exist in the watershed is primarily single-family housing associated with logging and agricultural production. See Land Use map (Map 52) in APPENDIX E for land use data from 2010. The majority of forestry operations take place in the coniferous upland forests. Aerial photos indicate active logging infrastructure and land parcels that have been logged within the watershed. The majority of the farming and pastoral land uses (agriculture) are in the floodplain valleys of Deep River and Crooked Creek. Many of the single family residential developments in the watershed are associated with agricultural operations. Lower Deep River and the town of Deep River, an unincorporated rural center, have some multi-family and single-family residential development not specifically associated with agriculture. Many homes along the waterways in the lower Deep River reach as well as near the Town of Deep River have privately held docks and other overwater structural development on the river.

Most of the land in Deep River, Crooked Creek, and Jim Crow Creek basins are privately held. According to the Protected Area Database (USGS 2012), there are state owned lands in the upper SMP reaches of Deep River. This land is primarily utilized for forestry. WDFW also has boat access property on Deep River. Additionally, Columbia Land Trust holds private conservation land in sections of Lower Deep River. Commercial/Industrial land uses in the watershed include a relatively new net pen facility just south of SR 4 that rears and releases hatchery raised fall Chinook and coho salmon. There is also a functional lumber yard in lower Deep River.

Deep River shorelines are the most modified in the watershed. This is particularly true in the lower reaches. A system of levees, tide gates and culverts controls tidal influences, and provides flood control to the floodplain valleys that support a variety of open space pasture for raising cattle and growing crops. Summaries of these shoreline modifications in each reach can be viewed in Appendix A. A map of shoreline modifications (Map 49) can be viewed in APPENDIX E.

Lower Crooked Creek has limited shoreline modification. There is a bridge crossing for Altoona Pillar Rock Road, but little or no development within the shoreline area until the upper reaches. At that point, rural single family unit development and agriculture have modified the land. Agriculture is generally above the upriver tide mark and there is no system of levees on the creek. Jim Crow Creek has little to no development. Logging roads and the presence of logging operations are present near the shoreline, but generally do not occur within it although culverts exist in the upper reaches.

Table 5.3 Land use in Wallacut Watershed

Land Use	Acres	Percent of Acres in Wallacut Watershed
Agriculture	882.53	3.51
Forestry	22,208.02	88.23
Government	4.50	0.02
Lodging	8.93	0.04
Non Commercial Forest	25.45	0.10
Open Space	569.56	2.26
Recreation	10.82	0.04
Residential (Multi-Family)	92.28	0.37
Residential (Single-Family)	744.00	2.96
Resource Production	18.54	0.07
Transportation	3.82	0.02
Undeveloped	601.05	2.39
Utilities	0.41	0.00
Total	**25,169.92**	**100.00**

Source Ecology 2010

Overall, the watershed is dominated by forestry operations. As a result, there is a large amount of logging road construction throughout. Road density in the Wallacut watershed varies but an extrapolation from an estimate of the Jim Crow Creek subbasin suggests that the watershed, has a high 5.14 miles/miles^2 (LCFRB 2010a). Increased road densities contribute to runoff pollution in watersheds. The higher the road density, the more likelihood of increased sedimentation and other runoff issues in the watershed.

Land use changes in the county are slowly shifting away from large agricultural operations. While not particularly evident in this watershed, agricultural production in the county as a whole has decreased and parcel sizes have subdivided to make room for smaller lots for residential development. In this watershed, subdivision of parcels has occurred slowly, mostly in the floodplains and near the rural center, the town of Deep River.

5.1.3 Public Access Opportunities

Deep River has a renovated boat launch and park facilities available to the public in the lower reach owned and managed by WDFW. Much of the shoreline along Deep River, Crooked Creek and Jim Crow Creek is land that is held privately. As a result there are several private docks and overwater structures in the Deep River basin, limiting public access in shoreline areas. Public moorage is available on Deep River south of SR 4. DNR land in the upper reach may provide some opportunities for future access as it is currently managed for multiple uses. Existing public access areas can be viewed in APPENDIX E (Map 56).

5.1.4 Protection and Restoration Potential

The ecosystem-wide analysis described in Section 2.3 utilized available data to evaluate identified ecosystem-wide processes and functions as well as impairments to these process and functions. APPENDIX D contains a table that shows the processes and impairments and the data used to evaluate them. According to the Ecosystem Analysis, impairments within the watershed are generally considered low. See Figure 5.1. Some exceptions occur, particularly along Deep River just north and south of State Route 4 where impairments are considered high. The reach matrix in APPENDIX A suggests some potential restoration opportunities on a reach by reach basis. A summary of potential restoration and protection focus areas within the watershed based on the Ecosystem Analysis include the following:

- Deep River, above reach 8, has relatively large areas recommended for protection, meaning many of the ecosystem functions/mechanisms are in relatively good condition.
- Three areas along Deep River (Reach 7 and Reaches 5 and 6) are recommended for restoration. Further investigation is needed, but areas reconnecting tidal influence to associated wetlands south of HWY 4 would benefit surface storage, historic hydraulics, and fish and wildlife habitat on relatively under-utilized agricultural land.
- A large portion of lower Crooked Creek is recommended for protection and upper portions of the creek appear to have functions and mechanisms intact.
- Lower Jim Crow Creek is considered to have the lowest impairments to ecosystem processes and the subsequent mechanisms and functions should be protected.

Several locations in the Wallacut watershed within Wahkiakum County have been identified as being of high importance and having moderate to high impairments. This is particularly the case in the lower reaches of Deep River and Crooked Creek. Many of the shoreline areas are identified for protection and restoration meaning they contain hydraulic, habitat, and nutrient functions important to the regional ecology. Lower Deep River has a lot of wetlands along the shoreline, but is largely cutoff from the mainstem of the river by a system of levees. As a result there are opportunities for restoration to improve hydraulics, sediment transport, nutrient circulation, etc. Despite the existence of levees, many of these floodplain areas serve important ecological functions and the ecosystem-wide analysis resulted in a "Protection" status. See Figure 5.2. Most of the larger impaired areas in this watershed are focused around SR 4, the main thoroughfare through the County. Moving up watershed, the systems become more confined. Logging roads and other land use development have larger impacts on the waterway in these areas, hence the increased impairments to ecosystem processes and functions and a ecosystem analysis result of "Restoration" in the upper shorelines of these systems.

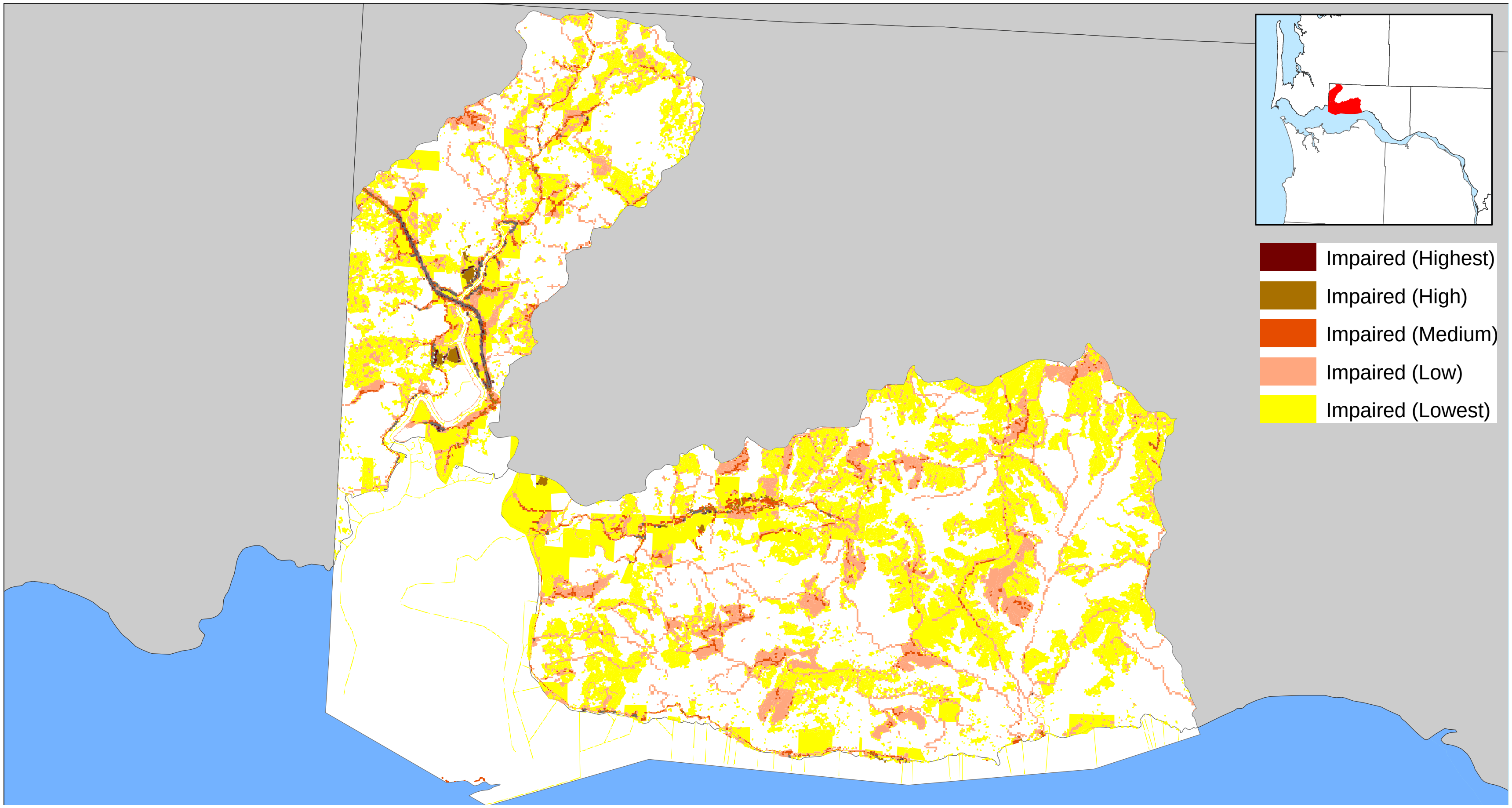


Figure 5.1 Wallacut and Baker Bay Watersheds: Ecosystem Analysis (Impaired Areas)

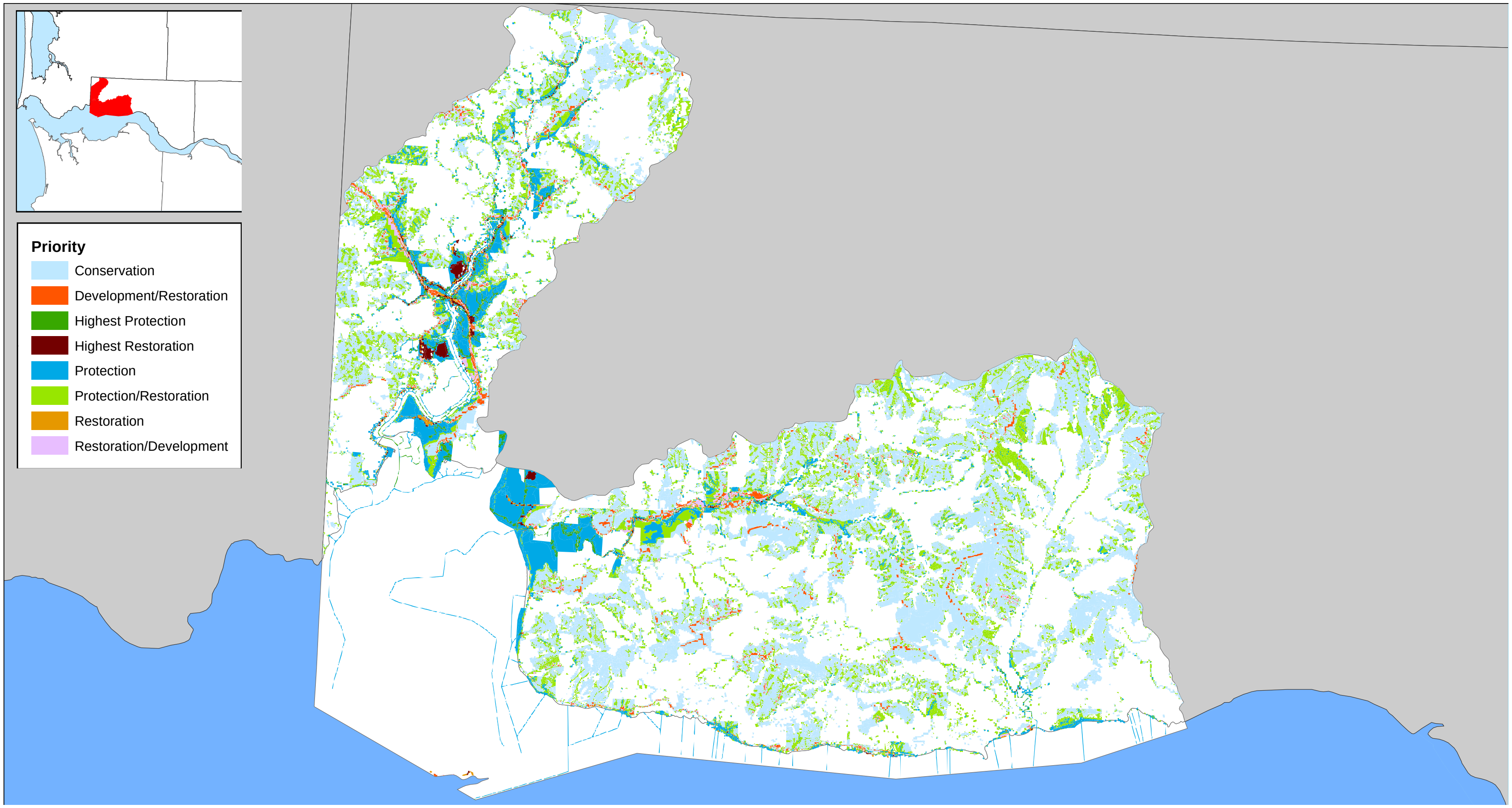
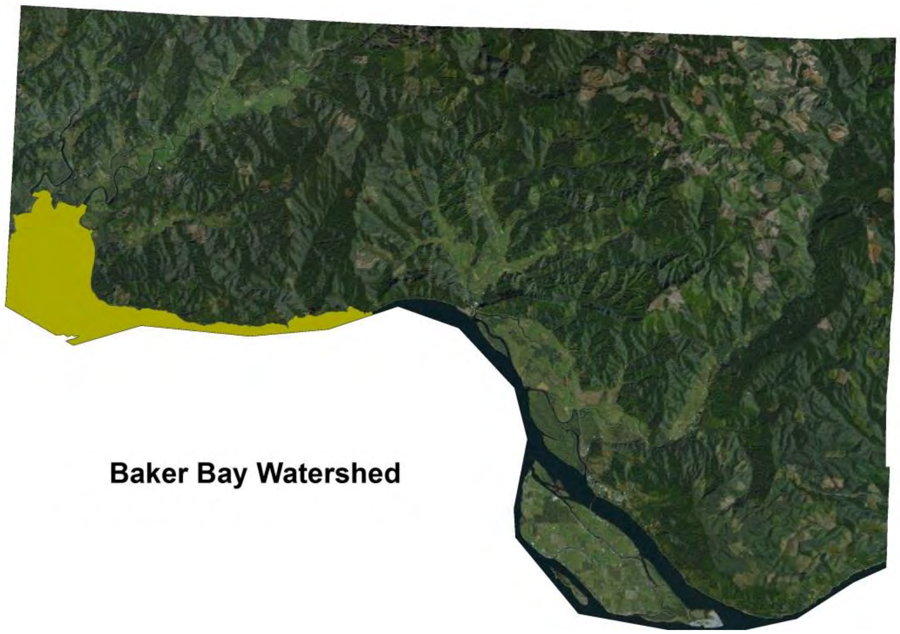


Figure 5.2 Wallacut and Baker Bay WatershedsEcosystem Analysis (Priority Areas)

5.2 Baker Bay – Columbia River



5.2.1 Physical and Biological Characterization

Baker Bay – Columbia River watershed is part of the mainstem of the Columbia River in the lower Columbia River Estuary and extends from just east of Jim Crow Creek in Wahkiakum County west to the Mouth of the Columbia River (Pacific County). Named for Baker Bay located downstream in Pacific County, only the Wahkiakum County portion of the watershed is covered in this section. The Wahkiakum County portion of the Baker Bay watershed includes Grays Bay, from the County line at Rocky Point, and extends upstream along the Columbia to Three Tree Point at approximately River Mile 30 (Map 6). Along the western and northern shores of Grays Bay are local features of Brix Bay, Miller Point, and the mouths of Deep River and Crooked Creek (Wallacut watershed) and Grays River (Grays Bay watershed). Along the eastern shores of the watershed are local features of Pigeon Bluff, Harrington Point, Elliot Point, and Jim Crow Point and rural hamlets of Altoona (historic), Carlson Landing, Dahlia, and Brookfield. Portions of this watershed that include "shorelines of the state'" include:

- Baker Bay (Reaches 1 – 17)
- Rice Island (Reaches 1 – 2)

The Northwest Power and Conservation Council (NPCC) identified two Columbia River provinces within the Baker Bay watershed primarily based on the extent of saltwater influence; the Columbia River Estuary (from the mouth of the Columbia River to River Mile 34) and the Lower Columbia River (River Mile 34 to the Bonneville Dam). The Baker Bay watershed in Wahkiakum County overlaps both of these provinces. The watershed is generally defined as waterward of the OHWM and covers open water, subtidal and intertidal habitat within the mainstem of the Columbia River. However, for the purposes of this report, SMA jurisdictional areas immediately adjacent the Columbia River are described in this section while areas futher landward are described in the Wallacut and Grays River watershed sections of this chapter (see Appendix E Map 6). The SMP jurisdiction within the Baker Bay watershed covers 454.42 acres of shoreline, including open water, shallow subtidal habitat, and intertidal habitat. Thirteen federally listed fish species that migrate through the Columbia River use this shoreline area, including eleven species of salmon, steelhead, , green sturgeon, and Pacific eulachon.

Reaches along the Columbia River have a variety of land use and land forms that include steep forested bluffs with little development, levied floodplains with agricultural and minimal residential development, and a National Wildlife Refuge managed for Columbian white-tailed deer. The shoreline reaches often contain impervious roadways, particularly in flatter, floodplain areas.

The Columbia River estuary is a high energy system with complex and dynamic interactions between river and tidal forces. The tidal influence affects the entire watershed and the streams and tributaries in the subbasins that flow into the Columbia River. The extent of tidal influence can be viewed in Map 17 in APPENDIX E. Tidal influence extends into many of the waterways in the Wallacut and the Grays River watershed, as described in this chapter. In the Baker Bay watershed, there is a high variability in circulation, sedimentation and biological processes that occur in the estuary (Sherwood and Creager 1990).

The Columbia River Estuary was formed by a combination/succession of natural forces including glaciation, volcanism, hydrology, erosion and accretion of sediments. The movement of sediments and nutrients throughout the estuary is the result of hydrology and coastal oceanography. Deposition of coarse and fine sediments is the result of historic sea level rise since the late Pleistocene period (Marriott et al. 2001, LCFRB 2010c). Within the BakerBay watershed in Wahkiakum County, there are no established main channel islands with the exception of the northeastern edge of Rice Island, a large US Army Corps dredge disposal site located mostly in Oregon waters of the Columbia.

Upstream dam construction has resulted in the current hydrological conditions. Additionally, irrigation withdrawals, shoreline armoring, channel dredging, and channelization pile dikes (wing dams) from the 1800's to mid-1900's have significantly modified estuarine habitats. As a result, significant changes to estuarine circulation, deposition of sediments, and biological processes have occurred in the BakerBay watershed and larger Columbia River Estuary (ISAB 2000, Bottom et al. 2001, USACE 2001, Johnson et al. 2003b). Deep River, Grays River, Crooked Creek, and Jim Crow Creek and many smaller tributaries all flow into the Baker Bay-Frontal Columbia watershed, although these tributaries are in the immediately adjacent Wallacut and Grays Bay HUC 10 watersheds (Refer to Sections 5.1 and 5.2).

Land cover within the watershed is dominated by open water (nearly 73%). However, the SMA shoreland area in this watershed is largely shrub and grassland habitat (26.30 percent) with some intermittent wetlands and forested areas. The shrub and grassland habitat is associated with wetland areas along the shoreline, particularly in Grays Bay, where accretion over the last century has resulted in the establishment of wetland vegetation such as *Carex lyngbyei* sedge, *Deschampsia caespitosa* tufted hair grass, *Juncus oxymeris* pointed rush, *Oenanthe sarmentosa* water parsley, and *Polygonum hydropiperoides* smartweed. Higher elevation wetland vegetation is characterized in part by *Salix sitchensis* Sitka willow, *Juncus effusus* common rush, *Impatiens nolitangere* touch-me-not, *Lysichiton americanus* skunk cabbage, and *Festuca arundinacea* tall fescue. See Land Cover map (Map 42) in APPENDIX E. Table 5.10 below summarizes the acreage and relative percentage of land cover in the watershed. Acreages are dominated by undevelopable wetlands followed by open water, forest and woodland and agricultural production. Logging and agriculture have been the primary economic drivers in the basin and the percentage of overall cover type of forest land and agriculture reflects those uses. The large number of wetlands and woodland areas suggests that there the amount of open space which generally maintains ecological functions in the basin. This is contingent on where new development is placed and the extent of ongoing impairments from past agricultural and logging practices.

Table 5.10 Baker Bay Watershed Land Cover

Land Cover Type	Acres	percent
Agriculture	10.45	0.15
Aquatic Vegetation	0.00	0.00
Developed	7.78	0.11
Forest and Woodland	39.79	0.57
Nonvascular & Sparse Vascular Rock Vegetation	0.00	0.00
Open Water	5080.22	72.87
Recently Disturbed or Modified	0.00	0.00
Shrubland & Grassland including wetlands	1833.31	26.30
Total	**6971.55**	**100.00**

Source: NLCD 2012

Wetlands and Floodplains

The structure and function of wetlands play an important role in the ecosystem processes that contribute to the greater Columbia River Estuary.

Historical wetlands along the shorelines in the Baker Bay watershed were dominated by tidally influenced herbaceous, shrub coniferous and deciduous wetlands within the floodplain. Tidal wetlands encompass both tidal swamp and tidal marsh. Both of these terms are from Thomas (1983) and have been replaced below with more frequently used and accurate terminology from

Cowardin (1979) (intertidal emergent/scrub-shrub and intertidal forested wetlands, respectively). Intertidal emergent/scrub-shrub wetlands areas are dominated by emergent vegetation and low shrubs and are found starting at MLLW, although they are rare at the lowest elevations. Intertidal forested wetlands are shrub and forest dominated wetlands, extending up to the line of non-aquatic vegetation (i.e., the line at which excess water ceases to be a factor controlling the composition of the vegetation). These areas may be of sufficiently high elevation that they are inundated only during spring tides, but they may also extend down below MHHW. An increase in tidal marsh habitat in Baker Bay over a century of time has resulted from the accretion of tidal flats and bulrush colonization (Thomas 1983, LCFRB 2010c). Table 5.11 shows estimated habitat changes for Grays Bay and other areas in the Columbia River Estuary between 1887 and 1983 (Thomas 1983).

Table 5.11 Estimated habitat changes in the Columbia River Estuary between 1870 and 1983.

Habitat Type	1870 Acreage	1983 Acreage	Change	Percent Change
Deep water	35140	32580	-2560	7.30 percent
Medium depth	34210	25720	-8490	24.80 percent
Shallows/flats	40640	44770	4130	10.20 percent
Intertidal emergent	161180	9200	-6980	43.10 percent
Intertidal forested	30020	6950	-23070	76.80 percent
Developed floodplains		23950		N/A
Uplands (natural and filled)	1930	7590		Not Calc.
Non-estuarine swamp		3320		N/A
Non-estuarine marsh		3130		N/A
Non-estuarine water	50	960		Not Calc.

Source: Thomas 1983

Water circulation in Baker Bay – Columbia River watershed is the result of interactions between fluvial flows and tidal interactions. Pile dikes constructed to maintain and stabilize the Columbia River navigation channel have decreased circulation in Baker Bay. As a result, flooding problems in the Grays and Deep River valley bottoms (Wallacut and Grays River Watersheds) frequently occur. Accretion rates in the bay have also increased resulting in the creation of new intertidal wetland habitat (Thomas 1983 and LCFRB 2010c) and decreased navigability. Dike construction, primarily for conversion to pasture, has isolated the main channel from its historical floodplain and eliminated much of the historical intertidal forested habitat (LCFRB 2010c).

The NWI Wetland map (Map 24) in APPENDIX E shows the spatial distribution of the different wetland types in Wahkiakum County and their relationship to the shoreline. Table 5.12 summarizes wetland types compared to the overall land area in the Baker Bay watershed. Emergent wetlands contribute to almost 13 percent of the total land area. While this represents a relatively large percentage, many of these emergent wetlands are depressional wetlands behind water control structures. Historically, many of these wetlands were connected via tide and flood cycles to streams and river systems. The ebb and flood cycles transported and deposited sediment and nutrients and provided habitat for a variety of species. While these wetlands continue to provide habitat for species, the vegetation communities and wildlife dynamics have changed. For example salamanders that generally thrive above the head of tide may find depressional wetlands behind a levee (protected from tide cycles) to provide adequate habitat. The shoreline along the Columbia River portion of the Baker Bay watershed is comprised of rugged terrain. Some low and floodplain areas occur between steep cliff faces and near river/stream mouths such as the area between Jim Crow Creek and Skamokawa.

Table 5.12 Wetlands in Baker Bay watershed

Associated Wetlands	Acres	percent Wetlands of total Watershed
Estuarine and Marine Wetland	57.41	0.81
Freshwater Emergent Wetland	904.30	12.83
Freshwater Forested/Shrub Wetland	84.70	1.20
Freshwater Pond	3.17	0.04
Floodplain	270.17	3.83
Total Watershed Area	**7048.59**	

Source: NWI 2012, WBD BLM 2013

Aquifer recharge areas

Columbia River alluvium, at or below river level, has the ability to produce groundwater throughout most of its thickness (Myers 1970; Ecology 1972; Krautkramer and Ellis 2000). Generally, the hydrogeology in this unit behaves as an unconfined aquifer (Myers 1970; Ecology 1972), but water level behavior and water quality data suggests that some areas within this unit may behave as a semi-confined to confined aquifer (e.g., Myers 1970; Krautkramer and Ellis 2000).

Recharge to this unit is likely from several sources including (Myers 1970; Ecology 1972):

1. The Columbia River and tributary streams,
2. Direct infiltration from precipitation,
3. Direct discharge of groundwater from bedrock aquifers.

Producing wells in the Columbia River alluvial unit range from a depth of 50 ft. to greater than 350 ft. (Myers 1970; Ecology 1972). Yields are typically in excess of 1,000 gpm (Myers 1970; Ecology 1972).

The Critical Areas Map (Map 14) in APPENDIX E shows likely areas where aquifer recharge areas may occur. In this watershed, aquifer recharge areas occur on geological units that are known for having a high to moderate rate of permeability. Other important areas, such as wetlands, streams, and water and resource protection well information, are also used to identify potential recharge areas. Much of the Columbia River mainstem and backwater sloughs, the 100-yr floodplain and the Columbia River tributaries are likely areas for aquifer recharge. The majority of the water and resource protection wells occur along the shoreline of the Columbia River in the Wahkiakum County portion of the Baker Bay watershed.

Fish and Wildlife Habitat

Thirteen federally listed fish species that migrate through the Columbia River utilize Baker Bay basin of the Columbia River, including eleven species of steelhead and salmon, green sturgeon, and Pacific eulachon. Fall Chinook and coho salmon had high numbers as they migrated up the Columbia in both 2013 and 2014. Numbers are estimated to be approximately 1.2 million and 1 million fish per species, respectively. These runs have increased the number of Chinook in the Lower Columbia tributaries as well, including those that enter the Baker Bay watershed.

The main components of the habitat formation process in the Bay and broader Columbia River estuary (bathymetry, water turbidity, salinity, nutrients, and woody debris) are interconnected and determine the location and type of habitats that form and persist. Habitat formation in the lower Columbia River mainstem and estuary are controlled by complex and dynamic interactions between river flows and tidal influences (LCFRB 2010c). Tides import marine-derived sediments and nutrients into the estuary while the river exports freshwater sediments, nutrients, and woody debris. This supply of sediments influences the bathymetry of the estuary (LCFRB 2010c). The flow of suspended sediments and organic matter determine the degree of water turbidity. Higher flows increase turbidity as sediments are picked up and carried downstream. Salinity gradient and the types and locations of nutrient input are determined by fluvial flows. The lower the flow, the greater the salinity from ocean influences. The recruitment of large woody debris is also dictated by fluvial discharge. Habitat-forming processes are also influenced by storms, extreme hydrologic events, or catastrophic events such as earthquakes. (LCFRB 2010c).

The habitat-forming processes of accretion, erosion, salinity, and turbidity in the Columbia Estuary affect the location of plants throughout the estuary. Vegetation communities and habitat types are also dictated by tidal and flood events that change the water surface elevations. This, in turn, affects the frequency, depth, duration of inundation, and elevation gradient, which impacts the development of particular species of vegetation at particular elevations as well as the processes that integrate floodplains, emergent wetlands and the mainstem of the river (ESA PWA, Ltd and PC Trask 2011, USACE 2001, LCFRB 2010c). These habitat forming processes also determine which fish and wildlife species associations occur in a particular area.

A variety of fish and wildlife species occur in the Columbia Estuary and Lower Columbia River. The species listed in APPENDIX F occur either as migratory inhabitants, seasonal residents, or year-round residents. This list is a comprehensive list applicable to all of Wahkiakum County, including Baker Bay watershed as well as other areas from the mouth of the Columbia River to Bonneville Dam. WDFW has identified priority habitat areas for a number of species in the watershed (See the Priority Habitat map (Map 26 in APPENDIX E).

As mentioned in the section above, water circulation in the watershed has been affected by shoreline modifications; for example pile dike construction has promoted intertidal and wetland habitat development in Grays Bay (Thomas 1983 and LCFRB 2010c). Broad tidal mud flats, submerged at high tide and exposed at lower tides, support rich communities of benthic organisms (worms and bugs) that support salmonids, waterfowl and the aquatic food web, although the related reduction in navigability is a concern for some local residents. See the Shoreline Modification map (Map 49) in APPENDIX E. Additionally, levee construction has isolated the mainstem from its historical floodplain and eliminated much of the historical intertidal forested wetland habitat (LCFRB 2010c).

Priority Habitat and Species (PHS) data from WDFW suggest that Grays Bay is a waterfowl concentration area, largely due to the calm open tidal and subtidal foraging habitat. Cavity nesting ducks are also known to use Grays Bay for foraging and rearing. (WDFW Comments 2015)Grays Bay is also known to have several harbor seal and/or sea lion haul-out sites on Rice Island and other areas. The watershed's steep shoreline cliffs are also an important area for birds of prey, particularly bald eagles, Northern goshawks, and peregrine falcons. They have been known to utilize and nest in areas along the Columbia River shoreline in the Grays Bay area of the watershed. Waterfowl concentrations including pied-billed grebes, northern pintails, and American coots) are also common along the shorelines near Grays Bay. Many of the large and small tributaries within the Baker Bay watershed along the Columbia River are spawning, rearing and migratory routes for salmonids (Maps 28-41).

Frequently flooded areas (Map 17)
Small intermittent floodplains exist along the Columbia River within the watershed and are prone to flooding during spring freshets. Development in the shorelines in the Wahkiakum County portion of the Baker Bay watershed is largely in the limited upland areas so flooding is much less a factor with regard to land use and development. Pile dike construction near the shorelines of the Baker Bay watershed has contributed to flooding problems in the lower Grays and Deep River valley bottoms in the Wallacut and Grays River Watersheds. (Thomas 1983 and LCFRB 2010c).

Geologically hazardous areas
The steep cliffs that characterize most of the shoreline in Baker Bay – Columbia River watershed and the soils common in these areas present a significant portion of high and moderate risk landslide hazard areas (CREST 2006) See Appendix E Map 19. As mentioned in previous sections, areas in broad floodplains and low lying elevation areas along the Columbia River generally have a low to non-existent level of landslide hazards (Landslide hazard map (Map 17) in APPENDIX E). However, floodplain areas and low-lying elevation areas present a high and moderate liquefaction hazard risk. See liquefaction hazard risk map (Map 21) in APPENDIX E.

5.2.2 Land Use and Shoreline Modifications
As mentioned above, much of the watershed contains open water. However, most of the shoreline area along the Columbia River in the Baker Bay watershed is considered open space (55 percent), along with additional undeveloped, forestry, agriculture, and single-family residential land uses. See Table 5.13 below. See Land Use map (Map 52) in APPENDIX E for land use data from 2010. Shoreline modificationsoccur throughout the watershed. The Shoreline Modification map (Map 49) in APPENDIX E shows areas where shoreline modification has been documented (LCEP 2012), including levees, tidegates, culverts, pile dikes, high and medium density piling fields, bridges and other overwater structures, dredge materials and disposal sites, armoring and low density residential.

The large percentage of open space, forestry, and agriculture suggests much of the shoreline adjacent to the Columbia River maybe impacted or impaired, but still contains important ecological functions or has the opportunity to restore ecological functions to the area. The large portion of open space is generally undeveloped wetlands and agricultural fields/pastures. Forestry operations in the uplands are visible on aerial photography. Residential development is rural and scattered along the shoreline. Single family residential acreage is approximately eight percent of land use by acreage.This is considered rural for the watershed, with a few exceptions where increased residential density along the shoreline is present in some areas with smaller parcel sizes along Altoona – Pillar Rock road, which runs along a portion of the shoreline in this watershed..

Shoreline modifications in County's portion of Baker Bay watershed include constructed levees and pile dikes. There is a pile dike in front of Rice Island to protect the island from fluvial forces and help shape the nearby Navigation Channel. Another pile dike is located just off the shoreline approximately halfway between Jim Crow Creek and the mouth of the Crooked Creek on the Columbia River. There is also a system of levees throughout the tributaries emptying into Grays Bay and along the eastern Grays Bay shoreline. There are some overwater structures on the mainstem of the Columbia River, but the majority of the shoreline is composed of steep upland cliffs. Low-lying areas are often filled with dredge disposal material. Lastly, some areas within the watershed have medium density pile fields along the shoreline (LCEP 2012).

Table 5.13 Land use in Baker Bay

Land Use	Acres	Percent of Acres in Baker Bay Watershed
Agriculture	11.34	4.79
Forestry	40.07	16.93
Open Space	132.06	55.80
Recreation	0.09	0.04
Residential (Multi-Family)	1.16	0.49
Residential (Single-Family)	19.98	8.44
Undeveloped	31.98	13.51
Total	236.68	100.00

Source: Ecology 2010

5.2.3 Public Access Opportunities (Map 56)

Informal view-only access areas such as road turn-outs and wide-shoulders along Grays Bay occur in a number of places, primarily on Altoona-Pillar Rock Road. No other known public access opportunities have been identified in this watershed. However, Grays Bay (within the Baker Bay watershed) is frequently utilized by kayakers and recreational fishermen who launch from the Elochoman Marina, Deep River and/or Skamokawa. Further discussion of existing and potential public access opportunities are described in those sections of this chapter and in Section 6.1.3.

Some informal access areas (view-only/road-side access) exists along Oneida Road and Altoona-Pillar Rock Road, where drivers, bicyclists, etc. can view the Bay.

5.2.4 Restoration Potential and Considerations

Much of the high ranking "Important Areas" occur extensively along the Columbia River shoreline and to a smaller degree, along small tributaries that flow into it, in the upland Wallacut and Grays River watersheds. "Impaired Areas" (Figure 5.1) that overlap with high ranking "Important Areas" occur generally where SR 4 and other impervious surfaces (i.e. development and roads) are relatively close to the shoreline (See Figure 5.2 above). Along the Columbia River shoreline, this is largely due to rural residential development. According to Figure 5.1, impairments to ecosystem processes that may affect processes in the Baker Bay watershed primarily occur between Crooked Creek and Jim Crow Creek along the shorelines of the Columbia River (i.e. Baker Bay reaches 7-14).

The Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (LCFRB 2010c) listed a number of strategies in the Columbia River Estuary and Lower Columbia River that pertain to the Baker Bay – Columbia River watershed. The strategies are as follows:

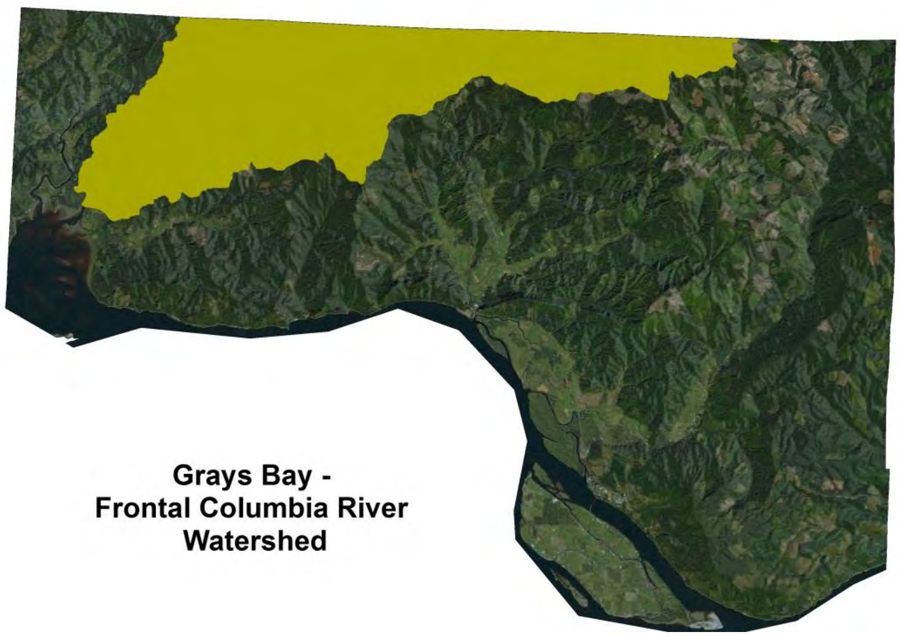
- Avoid large scale habitat changes where risks to salmon and steelhead are uncertain.
- Mitigate small-scale local habitat impacts such that no net loss occurs.
- Protect functioning habitats while also restoring impaired habitats to properly functioning conditions.
- Strive to understand, protect, and restore habitat-forming processes in the Columbia River estuary and lower mainstem.
- Improve understanding of how salmonids utilize estuary and lower mainstem habitats and develop a scientific basis for estimating species responses to habitat quantity and quality.

The subbasin plan also describes restoration measures, but stops short of identifying areas for consideration. The measures are listed below and will be utilized as part of the associated Wahkiakum -Cathlamet SMP Update Restoration Plan.

- Restore intertidal forested and emergent wetland habitat in the estuary and tidal freshwater portion of the lower Columbia River to improve fish and wildlife habitat, surface water storage, sediment transport regimes, and nutrient cycling.
- Protect and restore riparian condition and function to improve water quality, natural bank stabilization and erosion processes.
- Improve understanding of interrelationships among fish, wildlife, and limiting habitat conditions in the estuary and lower mainstem.
- Increase tagging and other marking studies to determine the origin, estuarine habitat use, survival, and migration patterns of various salmonid populations.
- Limit the effects of toxic contaminants on salmonid and wildlife fitness and survival in the Columbia River estuary and lower mainstem.
- Mitigate channel dredge activities in the Columbia River estuary and lower mainstem that reduce salmon population resilience and inhibit recovery.
- Restore connectedness between river and floodplain to improve nutrient cycling, water quality, sediment movement and off channel habitat
- Restore or mitigate for impaired sediment delivery processes and conditions affecting the Columbia River estuary and lower mainstem.

Some old growth stands on the shorelines of the Columbia River exist on the cliffs in the basin. Opportunities to continue to protect the old growth, nesting areas for cavity nesters and birds of prey, and areas of concentration for shorebirds and waterfowl should be reviewed for feasibility. Finally, numerous relic, derelict, and/or abandoned in-water, over-water and shoreline structures (pilings, docks, wharves, buildings) should be further evaluated for removal or containment. Altoona and Pillar Rock canneries?

5.3 Grays River – Frontal Columbia River



5.2.1 Physical and Biological Characterization

Grays River – Frontal Columbia River Watershed consists of approximately 31,000 acres. The SMP jurisdiction covers 2,424.34 acres of shoreline with approximately 178,256 linear feet (33 miles) of SMP jurisdictional streams. All jurisdictional shorelines flow into the Grays River, which ultimately empties into the Columbia River at Grays Bay. All floodplain, riparian, and upland SMA jurisdictional areas immediately adjacent to the Columbia River within the Grays River Watershed are summarized and described in the Baker Bay Watershed (Section 5.2) since the resources, land use, and any impairments directly affect the Columbia River (Baker Bay watershed). Map 6 in the Mapfolio generally shows the distinction between the watersheds, but Map 1 (Shoreline Jurisdiction) and Map 58 (Reaches) illustrates the relationship between the Columbia River and the adjacent SMA jurisdiction and reaches within the jurisdiction. The watershed is generally rain dominant, with only the highest points in the watershed above 2,500 feet elevation susceptible to rain on snow events. Streams/rivers containing "shorelines of the state" include:

- Grays River (GB_Reaches 1 – 18)
- South Fork – Grays River (GB_Reach 1)
- West Fork – Grays River (GB_Reaches 1 – 2)
- Fossil Creek (GB_Reaches 1 – 2)
- Klints Creek (GB_Reaches 1 - 3)

- Hull Creek (GB_Reaches 1 – 2)
- Seal Creek (GB_Reach 1)
- Seal Slough (GB_Reaches 1 - 2)

Many tributaries within the watershed drain into these waterways. While tributaries not mentioned above may not meet the qualifications for considerations as “shorelines of the state”, most of these tributaries likely qualify as critical areas regulated separately by the County’s CAO for their environmentally sensitive attributes.

The hydrology of Grays River is complex due to the presence of 2 opposing hydrological forces: fluvial flows downriver and tidal influences that push upriver during incoming tides. The approximate head-of-tide for Grays River (Map 17) can be seen in APPENDIX E. The head-of-tide for Grays River is located in GB_Grays River Reach 7 just south of the river’s intersection at SR 4.. Mean annual stream flow for the mainstem of the Grays River is estimated to be 1252 cfs (May et al. 2007 and TetraTech et al. 2009).

Many studies have been done to assess the hydrology, vegetation, wildlife, ecosystem function and restoration potential on Grays River (Pacific Water Resources 2004, West Consultants 2004, May et al. 2007, Tetra Tech Inc. 2009). A Pacific Water Resources (2004) study suggests that peak flows on the Grays River have not changed dramatically from historic conditions (one and two percent). West Consultants (2004) and Pacific Water Resources (2004) (From Tetra Tech et al. 2009) calculated various peak flow events as shown in Table 5.4 on the mainstem Grays River. Modeling by May et al. (2007) provided similar results when evaluating effects of timber harvest on daily, low, and peak flows, although low flows seem to have increased compared to the historic conditions (Tetra Tech, Inc. et al. 2009). Bankfull flows in the lower Grays immediately upstream of SR 4 appear to occur at a frequency of approximately once a year, similar to the recurrence found for most Western Washington Rivers (Castro 1997).

Table 5.4 Peak Flow Recurrence Events

Peak Flow Event	Historic Above Hull Creek (PWR 2004) cfs	Current at SR-4 (West 2004) cfs	Current above Hull Creek (PWR 2004) cfs
2-year	10,313	8,590	10,505
10-year	15,376	14,300	15,580
100-year	18,835	20,200	19,034

Source: Tetra Tech et al. 2009

The slope in the Grays River is generally low (<2%) along the wider floodplain valleys and increases upriver into the headwaters such as in the steep upper reaches in the Grays River gorge. Tributaries such as Klints Creek, Fossil Creek, upper West Fork, and upper Grays River have a moderate gradient with narrow channels and steep side-slopes. Upper Grays River is known for being flashy, with water moving fast and a lot of power through the confined river valleys and the steep canyon in the upper watershed. The powerful upper river means there is a lot of sediment moving down the watershed. This natural process is exacerbated by the historic logging practices that occurred in the upper watershed as vegetation on the landscape have been removed allowing for increased movement of sediment. Current and improved forest practices have reduced impacts on the system, but the existence of erodible soils in the upper reaches and the presence of largely unmanaged forest roads still present an issue. The increased sediment load moving downstream results in a rapidly changing channel morphology for the lower section of the river.

Tidal influence goes nearly eleven miles up the Grays River about as far as the confluence of Klints Creek (See Map 17in APPENDIX E). Lower Grays River (below head of tide)and its tributaries are largely levied. The majority of the levee construction is generally placed where tidal influence occurs. However, there was some levee construction for flood control around the confluence of the West Fork of the Grays River. As a result, there are only a few areas on the lower Grays River where the fluvial or tidal forces have access to adjacent floodplains, particularly where a few restoration efforts have occurred on land trust and/or public land (See Public Access Map56 in APPENDIX E).

The upper reaches of the Grays River have been subjected to significant changes in sedimentation, raising the river channel several feet. This is followed by periods of general scour and incision. It was channel aggradation and high flows that led to the major avulsion of the river through parts of the Grays River above SR 4 in 2008 and 2009. Floodplain inundation within the area of the avulsion occurred frequently and created a storage reservoir for sediment, preventing the sediment from moving downstream. These changes play an important role on the riverine ecology and on floodplain connectivity (Tetra Tech, Inc. et al. 2009).

Land cover within the Grays Bay watershed is dominated by coniferous upland forests. See Map 46 in APPENDIX E. The historic natural vegetation throughout the watershed was western hemlock climax forest on the hillslopes and Sitka spruce wetlands in the floodplains/tidal areas. Table 5.5 summarizes the current land cover types. Land cover is currently dominated by recently disturbed areas followed by woodland. Much of these disturbed area is the result of logging and pasture in both the floodplains and upland areas. Most of the functional old-growth wood was removed by harvest activities although some small old-growth stands remain in the upper watershed (May et al. 2007). As a result, the channel contains sparse accumulations of smaller-sized wood, lacking adequate LWD. Past and current forestry practices have caused most of the watershed to be in an early successional stage condition containing small trees. These trees are easily transported downstream and as a result, are generally unable to alter hydraulics or trap sediment (Tetra Tech Inc., et al. 2009). An increase in sediment supply downstream has resulted from the lack of large woody debris in channel. The volume of sediment being transported downstream is an issue not only for salmonids (channel stability), but also for residents living in the valley (increased flooding and bank erosion events).

The upper Grays River watershed is managed largely for timber by a few private timber companies (Pacific Water Resources, Inc. 2004). Table 5.5 reflects the large percentage of forested woodland as land cover (~50 percent). The amount of forest cover and clear-cut will vary significantly from year to year depending on the amount of recent timber harvest and re-growth. Impervious cover in the subbasin is primarily from the presence of roads and makes up a small percentage relative to the overall subbasin (Pacific Water Resources, Inc. 2004).

Agricultural uses have changed the natural vegetated conditions of the floodplains below the upper watershed/canyon area. The removal of historic Sitka spruce and deciduous riparian plant communities has made it easier for channels to migrate in response to sediment deposition and peak flow events. According to May et al. (2007), riparian areas throughout the watershed are classified as impaired or moderately impaired. Riparian areas are dominated by maple/alder forests (May et al. 2007). The channel in the lower river is also tending to widen and become shallower as a result of increased sediment delivery, potentially contributing to water quality issues such as higher temperatures; shallow water with wider surface area exposed to solar influence warms up more than deeper water. Channel migration has been limited by historic bank revetments in lower reaches of the river and confinement from roads and development. This has prevented the river from morphing and shaping naturally and has limited the establishment of valuable riparian and in-stream habitat.

Table 5.5 Grays Bay Watershed Land Cover

Land Cover Type	Acres	percent
Agriculture	3282.04	10.59
Developed	77.14	0.25
Forest and Woodland	15389.83	49.66
Nonvascular & Sparse Vascular Rock Vegetation	22.67	0.07
Open Water	224.75	0.73
Recently Disturbed or Modified (includes clear-cuts)	11582.27	37.37
Shrubland & Grassland	412.59	1.33
Total	**30991.29**	**100**

Source: NLCD 2012

Larger areas within the floodplain valleys were diked and converted to agriculture and pasture. Due to the levee system, the Grays River has limited or no floodplain connectivity in much of the lower floodplain areas. However, the area between Seal Slough and Grays River is still tidally influenced despite being surrounded by a system of levees. This is due to floodplain reconnection projects (Kandoll Farm/Seal Slough, Mill Road, and Devil's Elbow) that connect the mainstem of the Grays River to the floodplain surrounded by Seal Slough and the Grays River. The land cover map (Maps 46) in APPENDIX E shows areas where tidal wetlands still occur. See further description below of estuarine emergent and aquatic bed features.

Tetra Tech., Inc. et al. (2009) developed several reaches within their study area for the Grays River based on their own assessment of hydrology, vegetation, land use and geomorphology. Seven reaches were described in the 2009 report. The reaches established for this SMP characterization report correspond with the reaches, and to some degree, with the LCFRB 2009 and Tetra Tech 2009 report. Reaches are described in Appendix A and Mapped in APPENDIX E (Map 58)

Wetlands and Floodplains

The structure and function of wetlands in this watershed play an important role in the ecosystem processes that contribute to the Grays River, Baker Bay watershed and the greater Columbia River Estuary.

Tidally influenced wetlands have been significantly reduced by the construction of levees and water control structures and the advent of agricultural practices in the floodplain. Currently, there are significant areas of wetland habitat in the lower Grays River (below State Route 4) including palustrine emergent, shrub and coniferous forest wetlands as well as tidally influenced estuarine wetlands located at the mouth of the Grays River (Tetra Tech Inc., et al. 2009). Several wetland areas above SR 4 exist, including a number of old oxbows and fringe riverine and channel wetlands. Approximately, 6.4 percent of the watershed area consists of emergent wetlands and 3.7 percent is forested and shrub wetlands. Of the emergent wetlands, only a small amount in this watershed is tidally influenced due to human-influenced activities because much of the lower portion of the river that is tidally influenced has been cut off from the floodplains by a system of dikes and levees. This has impacted ecosystem-wide processes such as sediment transport, nutrient cycling, river and stream hydraulics and historic habitat structures in the Grays River. Table 5.6 summarizes wetland and floodplain areas in the entire Grays River HUC 10 watershed. The majority of emergent wetland occurs in the tidally influenced reaches of the lower Grays River. Depressional forested and shrub/scrub wetlands in this watershed tend to occur above the head of tide in non-SMA tributaries to the Grays River or behind water control structures in the lower reaches. See NWI Wetland map (Maps 24) in APPENDIX E.

Many of the wetlands in this watershed are in the floodplain and, based on aerial photography and elevation data (DEMs and LiDAR), seem to be hydrologically connected to the overall watershed/drainage system. Some wetlands appear to be depressional and isolated from the local surface hydrology. Review of aerial imagery and elevation models exclude these wetlands from the SMP's Associated Wetlands category because they are depressional wetlands, likely ephemeral and disconnected hydraulically from other waterbodies. Both Associated Wetlands and these isolated wetlands are depicted in Map 1 in APPENDIX E. Further field verification may be necessary to understand the realized hydrological connection between wetlands and the river and stream hydrology.

Table 5.6 Wetlands in Grays Bay watershed

Associated Wetlands	Acres	percent Wetlands of total Watershed
Freshwater Emergent Wetland	1,981.77	6.38
Freshwater Forested/Shrub Wetland	1,168.51	3.76
Freshwater Pond	10.61	0.03
Floodplain	3,257.57	10.48
Total Watershed Area	**31,081.15**	

Source: NWI 2012, WBD BLM 2013

<u>Aquifer Recharge Areas</u>

Alluvium along the floodplain of the Columbia River within WRIAs 25 consists of upstream sediments from the Columbia River basin and sediments within streams and rivers, such as the Grays River in WRIA 25. The majority of the alluvial sediments consist of sand, and to a lesser extent, silt and gravel (Gates 1994, LCFRB 2001). The dominance of sand results in the presence of highly permeable aquifers (LCFRB 2001).

A technical memorandum from Economic and Engineering Services, Inc. (2002) identified the issue of gravel build-up near the Grays River well field and treatment facility. It was recommended in the memo to remove the gravel in order to reduce flooding problems, while also improving habitat conditions in the Grays River.

The hydraulic characteristics of the unconsolidated to poorly consolidated sediments of the Alluvium and Older Alluvium deposits are highly variable and dependent on the geologic source of the sediments, mode of deposition, and thickness (LCFRB 2001). The alluvial deposits in the Grays Bay watershed can generally be divided into two categories, based on primary sediment-source region. Table 5.7 summarizes the extent across the two geologic units.

Table 5.7 Extent of main aquifers with in the Grays River valley

	Geologic Units	
Subbasin	**Alluvium and Older Alluvium (Acres)**	**Columbia River Basalt Group (Acres)**
WRIA 25 Grays River	8,359	1,932

Source: LCFRB 2001

The Critical Areas Map (Map 14) in APPENDIX E shows likely areas where aquifer recharge areas may occur. In this watershed, aquifer recharge areas occur on geological units that are known for having a high to moderate rate of permeability. Other important areas, such as wetlands, streams, and water and resource protection well information, are also used to identify potential recharge areas. Much of the Grays River channel, the 100-yr floodplain and tributaries to these waterways are likely areas for aquifer recharge. Most wells occur along the Grays River in the floodplain and near some of the upper tributaries. See Map 14 in the Mapfolio.

Fish and Wildlife Habitat

The Grays River watershed has historically provided a variety of riverine, riparian, intertidal, and upland habitat for a variety of species. Land use modifications such as levee construction, agriculture and logging have changed the landscape and the habitat functions that it serves. WDFW has identified priority habitat areas for a number of species in the watershed (See the Priority Habitat map (Map 26) in APPENDIX E). All 13 listed Columbia River salmonid species utilize Grays River. The lower reaches are also known spawning areas for Pacific eulachon. The tidal reaches are also known to host Green Sturgeon. The WDFW's PHS database identifies several areas in the watershed as important habitats including Palustrine and Riverine perennial aquatic habitat and cave features as well as important biodiversity corridor for wildlife. Elk can be found in the upland areas within the upper Grays River watershed. Migrating and nesting marbled murrlets have also been observed in the upper Grays River watershed. The lower reaches of Grays River is an important area for waterfowl concentrations and cavity-nesting ducks, while the upper floodplains host habitat areas for Sandhill cranes (*Grus canadensis*) migrations. The upper watershed also has known occurrences of Dunn's (*Plethodon dunni*) and Van Dyke's (*Plethodon vandykei*) Salamanders Bald eagles (*haliaeetus leucocephalus*) have been observed nesting and feeding throughout the watershed. Old growth stands and other areas with important habitat features in the upper watershed are also designated state management area for the Northern spotted owl (*Strix occidentalis*).

Map 28-41in APPENDIX E shows the distribution of various salmonids within the Grays Bay Watershed. Fall Chinook are native but the natural spawning stock is now mixed with hatchery raised fish due to the Grays River Salmon Hatchery on the West Fork Grays River. Hatchery supplementation was decommissioned in 1998 but the stock is still considered mixed (WDFW 2011, Tetra Tech Inc., et. al. 2009). All 13 listed Columbia River Salmonid Evolutionary Significant Units (ESUs) and green sturgeon (southern DPS) have been known to utilize the tidal reaches of the river and stream systems in the watershed. Additionally, the Grays River is known for its spawning and rearing habitat for Pacific eulachon (*Thaleichthys pacificus*) (See PHS map 26 in APPENDIX E). Table 5.8 lists salmonid presence and life-cycle activity in the Grays River.

Chum, coho, and fall Chinook are most impacted by conditions within the middle mainstem and the lower portion of middle mainstem tributaries (i.e., Fossil Creek, Crazy Johnson Channel (not an SMA stream)). Agricultural uses dominate the riparian areas and floodplains of these reaches, with forestry activities as the primary use on the surrounding hill slopes. The channel has been altered significantly due to past splash-damming, channel straightening, streambank hardening, and more recent flood control activities. The mainstem headwaters, East Fork Grays River, South Fork Grays River, and West Fork Grays River primarily support winter steelhead spawning and rearing. These reaches have been impacted most by recent and historical forest practices (including splash dam logging), which have disrupted riparian function, hydrology, and sediment supply processes.

Lower Columbia chum salmon primarily spawn in the Grays River watershed. The watershed is one of the last remaining significant producers of chum. This population is primarily wild and native, although a small hatchery program commenced in 1998 (WDFW 2011). The chum population is listed as "depressed" by WDFW (WDFW 2011). Spawning primarily occurs just downstream of SR 4 to 0.5 miles above the West Fork confluence.

Coho salmon are native to the Grays River, but the population is now considered mixed between wild and hatchery fish. Historic runs are estimated to have ranged between 5,000 and 40,000 individuals (LCFRB 2010a). WDFW lists the population status of the stock as "unknown" due to a lack available data (WDFW 2011). Spawning occurs primarily in the upper watershed in the major tributaries.

Winter steelhead stocks are considered wild and are native to the Grays River. Some small hatchery stocks have been released but do not contribute to natural spawning. The stock is listed as "Depressed" by WDFW (WDFW 2011). Spawning occurs throughout the basin.

In-stream salmonid habitat in the Lower Grays River is predominantly riffle habitat from approximately RM 18 to RM 10. Below RM 10, habitat is considered sand bed tidal. Upstream of SR 4, the majority of the habitat is suitable for spawning based on substrate, depth, and velocity criteria, although only about 20 percent of the habitat is considered "high quality" (May et al. 2007).

May et al. (2007), Tetra Tech et al. (2010) and LCFRB (2010a) all suggest that the most important limiting factors for salmonid production in the Grays River are substrate stability and excessive fine sediments as well as a lack of habitat diversity for various other life history stages. According to Tetra Tech et al. (2010) and LCFRB (2010a), other limiting factors throughout the salmonid life cycle within the basin include temperature, habitat diversity, key/essential habitat availability, pathogens, competition, and predation.

Table 5.8 Salmonid presence in the Grays River Subbasin

Fish Presence in the Grays River Subbasin		
Species	**Location**	**Life History and Timing**
Chum (Tier 1)	• Spawn from covered bridge to 0.5 mile upstream of West Fork confluence • Tributary spawning occurs on West Fork, Crazy Johnson Creek, Gorley Creek, Fossil Creek, Hull Creek	• October – November: freshwater return; in -migration • November – December: spawning • December – March: egg incubation • February – March: early rearing • March – May: fry migration
Fall Chinook (Tier 2)	• Spawning occurs from RM 10.7 (covered bridge) to RM 1.2 (Salmon Hatchery)	• August – November: freshwater return; in -migration • October – December: spawning • October – February: egg incubation • February- April: early rearing • March – June: rearing • July – November: ocean entry; out-migration
Coho (Tier 3)	• Thought to spawn in all available tributaries • Good production potential noted for Hull, Fossil, Mitchell Creeks; W, E, S, N Forks of Grays	• August – November: freshwater return; in -migration • October – January: spawning • October – March: egg incubation • March – May: early rearing • March – May (1+ years): rearing • May – June: ocean entry; out-migration
Coastal Cutthroat (Tier 3)	• LFA indicates presence throughout the watershed; resident forms have been observed throughout the basin. • Access to most of the watershed except upper tributary reaches	• June – October: freshwater return; in -migration • December – May: spawning • January – June: egg incubation • May – June: early rearing • January – March (2+ years): rearing • March – July: ocean entry; out-migration
Winter Steelhead (Tier 4)	• Native to Grays River; no detail on spawning areas available in LFA	• November – March: freshwater return; in -migration • December – May: spawning • December – June: egg incubation • July – August: early rearing • September – June: rearing

Source: LCFRB 2003

The natural riffle-pool morphology has largely been changed by sediment deposition and is now an unstable riffle or plane-bed dominated channel with infrequent scour pools associated with banks and artificial structures. The riffles scour frequently and the pools fill in with sediment. Only in areas with unique geologic features that cause scour (such as Maki Point adjacent to a diked right bank) do pools persist.

Many of the natural off-channel and wetland habitats have been highly modified and/or disconnected from the mainstem Grays River (Tetra Tech, Inc., et. al. 2009). According to Tetra Tech., Inc., et al. (2009), fish stranding in the floodplains frequently occurs during flood events. Much of the historic floodplain habitat has been modified as the result of agriculture and the construction of the levee system and revetments in the lower Grays River and above SR 4.

Frequently flooded areas
According to FEMA/FIRM data (FEMA 2010), much of the floodplain areas on the Grays River and its tributaries are considered "Special Flood Hazard Areas". The majority of the mainstem and its larger tributaries in Wahkiakum County are part of the 1 percent annual flood risk (100-yr floodplain) and are considered "flood hazard areas" (FEMA 1996 and CREST 2006). In general, the majority of the floodplain of the mainstem Grays River is frequently inundated. Flooding regularly affects agricultural fields and residences. Reports suggest the situation may be getting worse due to river bed aggradation resulting from upriver forest practices and subsequent sediment delivery (Tetra Tech et al. 2009).

Geologically hazardous areas
General slope and soil types within the Grays Bay watershed indicate that the large floodplain areas up and down the basin provide landslide risk protection from the more rugged terrain on either side of the floodplain (CREST 2006). Therefore, shorelines of the state are generally not prone to landslide hazards. However, the further up the watershed, the more narrow the floodplain becomes and the likelihood of landslide hazards along the shoreline increases (CREST 2006). Inmost of the upper Grays River watershed outside SMA jurisdiction, soils are predominately "rocky" where the depth to bedrock is less than 10 feet (Pacific Water Resource, Inc. 2004). This has led to the upper watershed having a reputation for high frequency of landslides (Landslide hazard map (Map 19) in APPENDIX E).

More than half of all the soils in the Grays River watershed are "A & B" type soils, which largely occur in the lower portions of the watershed (Pacific Water Resources, Inc. 2004). Highly erodible soils combined with ground disturbing activities, particularly in the middle subbasins can result in slope failures along the shorelines. Common ground disturbing activities in the Grays Bay watershed include logging and road-building (WCFHMP 2006). Recent surficial landslides are documented on the Grays River Hatchery Access Road, approximately 2.5 miles north of SR 4, resulting from saturation of colluvium during heavy rainfall events. The evaluation of these slides concluded that they are typical of other documented landslides in the area. (GeoEngineers 2009)

Moderate to high liquefaction hazard risk areas occur in the Gray's River floodplain and from the mouth of the River to the upper reaches in northern Wahkiakum County. Other areas with a moderate to high risk of liquefaction hazard occurs along the tributaries to the Grays River, including Hull Creek, Klints Creek, West Fork of the Grays River, and Fossil Creek.

5.2.2 Land Use and Shoreline Modifications

Most of the Grays River basin is managed for commercial timber production and has experienced intensive past forest practices activities. Approximately 90 percent of the upper Grays River watershed is forested (above SR 4) (May et al. 2007). About five –37.37 percent of the watershed can be classified as recently disturbed (clear-cut or burned) (see Table 5.5 above). Dominant floodplain valley land use is primarily agriculture and pastureland/modified open space. Rural single-family residential development occurs throughout the valley. Rosburg and the town of

Grays River serve as the rural centers within the watershed where Single-family, multi-family and commercial land use types are concentrated. Table 5.9 summarizes land use patterns within the watershed. See Land Use map (Map 50) in APPENDIX E for land use data from 2010. Forestry represents the largest land use in the watershed followed by Agriculture. Also, Grays River is a rural center in the watershed and contributes to the increase in the percentage of residential development in the watershed. Open space includes pasture and undevelopable wetlands.

Most lower and middle mainstem and tributary stream reaches are used for agriculture or rural residences. The construction of levees, bank stabilization, and riparian vegetation removal has impacted ecosystem function throughout the watershed (LCFRB 2010a). These actions not only impact fish and wildlife habitat, but also contribute to floodplain disconnection which contributes to a decrease in surface water storage and increases stream flow and velocities. See Impaired Areas table in APPENDIX D for general a description of alterations, their causes and indicators.

Most of the land parcels in the Grays River watershed are privately held. According to the Protected Area Database (USGS 2012), there is a state owned property in the upper SMP reaches of Grays River. This land is designated for multiple-use meaning timber production, biking, and hiking. NRCS also holds some ________________ (WRP)? conservation easements on private property in the lower reaches. The Columbia Land Trust holds private property in the lower and upper reaches of the Grays River for wildlife habitat. Additionally, a lot of attention and funding have been applied to the upper watershed for restoration work intended to slow the impacts resulting from large sediment loads from being carried downstream during seasonal flashy freshet episodes.

Shoreline modification (Appendix E Map 49) in the Grays River basin is primarily concentrated in the lower reaches although the upper watershed contains a high number of stream crossings (May et al. 2007). Much of the lower Grays River is confined by a system of levees and other water control structures to allow farming and other land uses in the floodplains and protect those land uses from flood events. Only a few overwater structures, such as docks and houseboats, exist on the river (Map 49). Most of these structures exist down river of Rosburg. Some pilings also exist just upriver of the Town of Grays River.

Past actions by the U.S. Army Corps in partnership with the County Conservation District investigated and implemented a variety of streambank protection projects that included rip rap replacement, stone revetments, gravel dikes, gravel removal, etc. The Grays River Habitat District currently maintains these structures. Pile dike and jetty construction in combination with land subsidence behind dikes, sediment build-up in the lower reaches from historic forestry practices in the upper reaches have resulted in flooding problems in the Grays valley bottoms (Thomas 1983 and LCFRB 2010a).

Other shoreline modifications resulting from past forest practices such as the construction of logging roads and clear-cutting have reduced shoreline and in-stream habitat quantity and quality by altering stream flow, increasing sediment, and degrading riparian zones. Effects have been magnified due to high rainfall and erodible soils. Historically, forest road culverts have blocked fish passage in small tributary streams (LCFRB 2010a), but the logging companies and agencies have been working to replace culverts and repair roads to standards that have improved fish passage in the upper reaches. In the lower reaches, the construction of levees, bank stabilization, and riparian vegetation removal have heavily impacted riparian and in-stream habitat in these areas (LCFRB 2010a).

Lastly, the Grays River drainage has been the subject of several watershed analyses, strategic plans and on the ground conservation efforts to protect and restore salmonid rearing and spawning habitat including: LCFRB 2010a, May et al. 2006, LCEP 2010, Tetra Tech et al. 2010.

Table 5.9 Land use in Grays Bay Watershed

Land Use	Acres	Percent of Acres in Wallacut Watershed
Agriculture	1,441.21	4.71
Forestry	26,606.98	86.93
Government	18.43	0.06
Lodging	21.95	0.07
Non Commercial Forest	63.09	0.21
Open Space	1,045.16	3.41
Recreation	2.19	0.01
Residential (Multi-Family)	17.69	0.06
Residential (Single-Family)	914.73	2.99
Resource Production	2.49	0.01
Retail	1.99	0.01
Transportation	0.06	0.00
Undeveloped	467.71	1.53
Utilities	4.09	0.01
Total	**30,607.76**	**100.00**

Source: Ecology 2010

5.2.3 Public Access Opportunities

There are two known public access sites in this watershed including river beach access and boat launches. One boat launch location is at the Rosburg Boat Launch located behind the Rosburg Community Hall. Ahlberg Park, located on the south side of the Grays River covered bridge also provides shoreline access via a unimproved boat launch to the public. Additional public access locations including public road-end right of ways could be considered where public conservation funds are utilized to purchase properties for floodplain and riparian restoration on both the upper and lower sections of the Grays River. Informal view-only access areas such as road turn-outs and wide-shoulders along the Grays River occur in a number of places, particularly on Barr Road, and Covered Bridge Road. Further discussion of existing and potential public access opportunities are described in Section 6.1.3. Existing public access areas can be viewed in APPENDIX E (Map 56)

5.2.4 Restoration Potential and Considerations

Section 5.1.4 discusses how Important Areas and Impaired Areas were identified and compared. The same methodology was utilized for the Grays River watershed. The Grays River Basin contains several locations that have both high ranked "Important Areas" and high to moderate level of impairment. Much of the high ranking "Important Areas" is in the floodplains of the rivers and tributaries, where, subsequently, much of the development and impaired areas also occur.

See Figure 5.3 and Figure 5.4 below for a map of Important vs. Impaired areas. The reach matrix in APPENDIX A also suggests potential restoration opportunities on a reach by reach basis. The Grays River is known to be an extremely flashy system resulting in high erosion rates, and flooding episodes. Development (rural residential, agricultural and forestry operations) in the upper reaches of the Grays River and its SMA tributaries have exacerbated the effects downstream, particularly with regard to the issue of sediment loading near the mouth, while causing massive erosion in the upper portion of the river. As a result, areas upstream of Hull Creek to just north of State Route 4 (Reaches 6-9) have a medium to high impairment rating based on the results from the ecosystem analysis. As a result these areas have been prioritized as potential restoration and/or focus area for lower impact development. Higher restoration priorities, according to the ecosystem analysis include Grays River reaches 8-13. Many of these restoration opportunities would likely involve restoration of riparian corridors, culvert replacements, and where applicable, floodplain/wetland reconnection to the main channel.

Restoration actions to alleviate and/or mitigate the scale of sedimentation within the lower Grays would benefit habitat as well as property and infrastructure. Confinement of the river with a large sediment supply increases the potential for detrimental changes in channel geometry, impacts that can be significantly reduced by improving floodplain connectivity in areas of low flood risk. (Tetra Tech., Inc. et al. 2009).

Habitat protection and restoration considerations for the Grays River watershed identified by Wade (2002) and LCFRB (2010a) include chum and Chinook salmon spawning areas in the mainstem Grays River, steelhead spawning and rearing areas in the East Fork Grays River.

The ecosystem analysis confirms the need for habitat restoration, riparian vegetation establishment and sediment control. These issues drivegeneral restoration priorities based on the studies and planning documents produced by TetraTech et al (2009), LCFRB (2008), May et al. (2007) and Streamfix (2004) within the Grays River watershed include:

- Protect stream corridor structure and function;
- Protect hillslope processes;
- Restore degraded hillslope processes on forest and agricultural lands with an emphasis on reducing sediment supply;
- Restore floodplain function and channel migration processes in lowland agricultural areas;
- Restore riparian conditions throughout the basin;
- Restore degraded water quality with emphasis on temperature impairments;
- Temperature monitoring;
- Create/restore off-channel and side-channel habitat;
- Restore channel structure and stability;
- Provide for adequate in-stream flows during critical periods;
- Restore access to habitat blocked by artificial barriers;
- Limit timber harvest on steep slopes and/or erodible soils/material;
- Lengthen timber harvest rotation;
- Decommission inactive forest roads and restore natural drainage ways;

- Construct LWD structures in the upper watershed to trap sediment and improve habitat;
- Establish a channel migration zone upstream of SR 4;
- Construct LWD structures in the response reach and CMZ upstream of SR 4;
- Support local efforts to improve watershed conditions;
- Monitoring of existing and proposed in-stream and bank structures;
- Evaluate tide gates and replace for fish passage as appropriate;
- Evaluate and research stability options for tidal reach.

The Grays River basin has been evaluated for its restoration potential in several reporting documents (TetraTech et al. 2009, LCFRB 2008, and Streamfix 2004 and May et al. 2007) with an emphasis on habitat restoration and sediment control. APPENDIX A includes some potential restoration opportunities in the Grays River basin identified by Tetra Tech Inc., et al. (2009).

Specific restoration actions (not including mitigation actions) identified in the reach matrix in APPENDIX A (Tetra Tech Inc., et al. 2009) are intended to be a tool restoration practitioners and willing landowners to use to develop and implement habitat restoration projects in the lower Grays River watershed. Participation in habitat restoration projects is entirely voluntary. No projects can or will be done without a willing landowner. The projects identified in this study are conceptual and must have further engineering analysis and design to evaluate effects on neighboring properties, reach-level conditions, and watershed processes. Further identification of potential restoration sites and methods will be developed through the Restoration Plan drafted and finalized during the SMP process.

Additionally, several projects have been completed and others are in the planning stages for sections of the upper Grays River basin in Pacific County. The Cowlitz Tribe and the Lower Columbia Fish Enhancement Group (LCFEG) and other partners have been active in Pacific County reaches. Projects include a mass wasting pullback project, road abandonment project and a habitat enhancement project. These projects are intended to reduce sediment transport downstream into Wahkiakum County that currently result in exacerbated erosion issues in the upper reaches of the channel as well as accretion rates in the lower Grays River near the mouth.

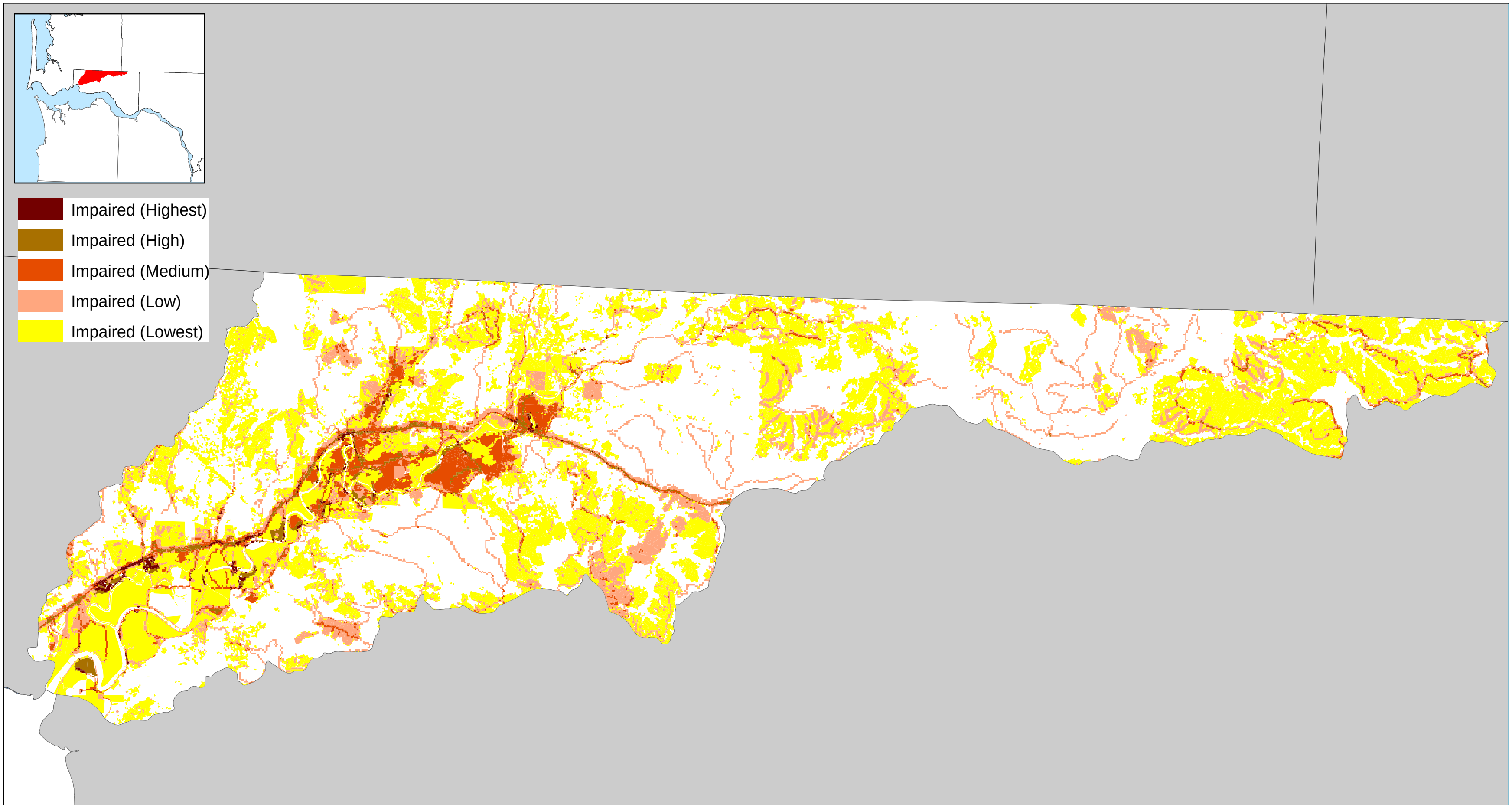


Figure 5.3 Grays River Watershed Ecosystem Analysis (Impaired Areas)

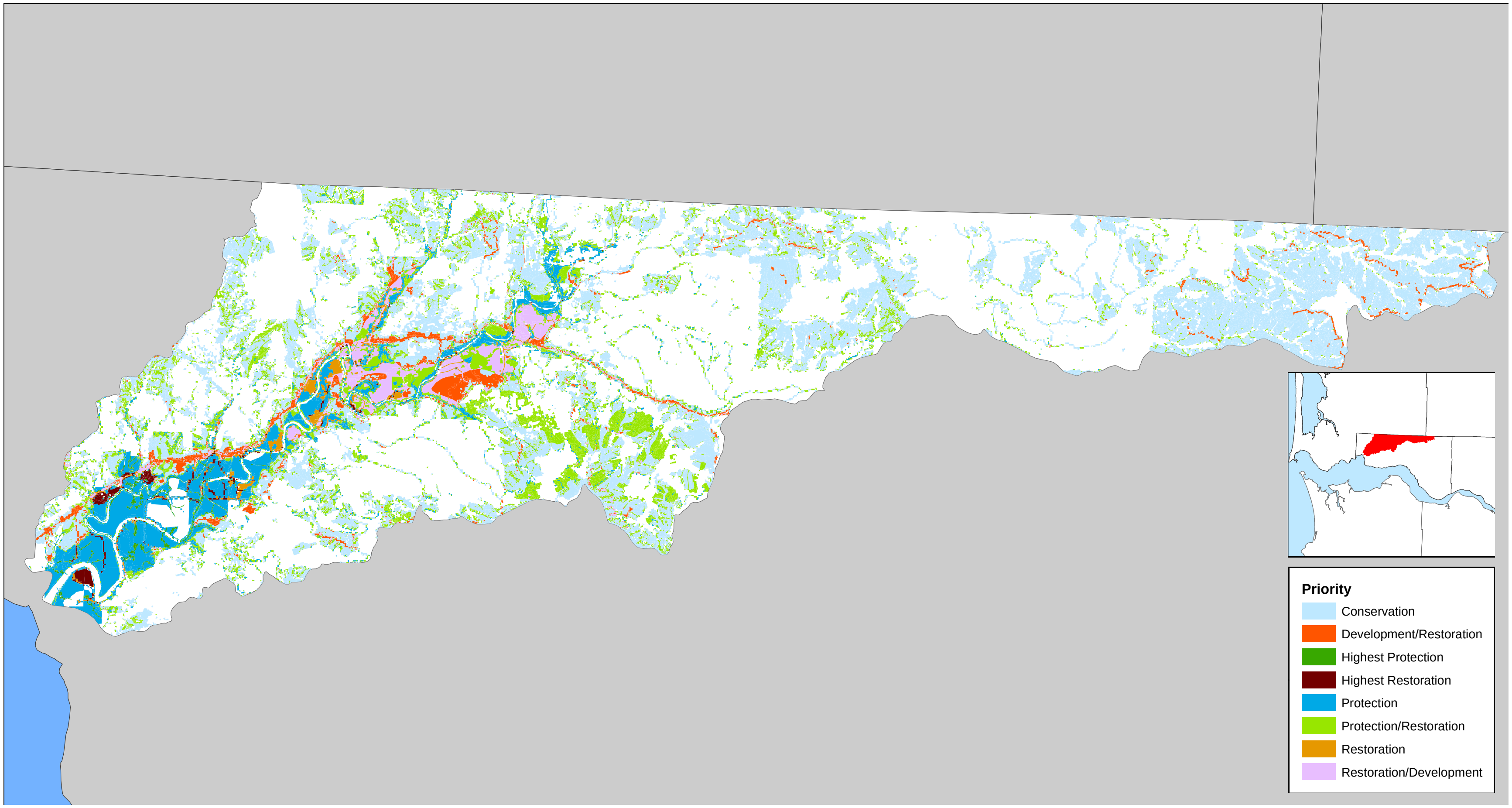
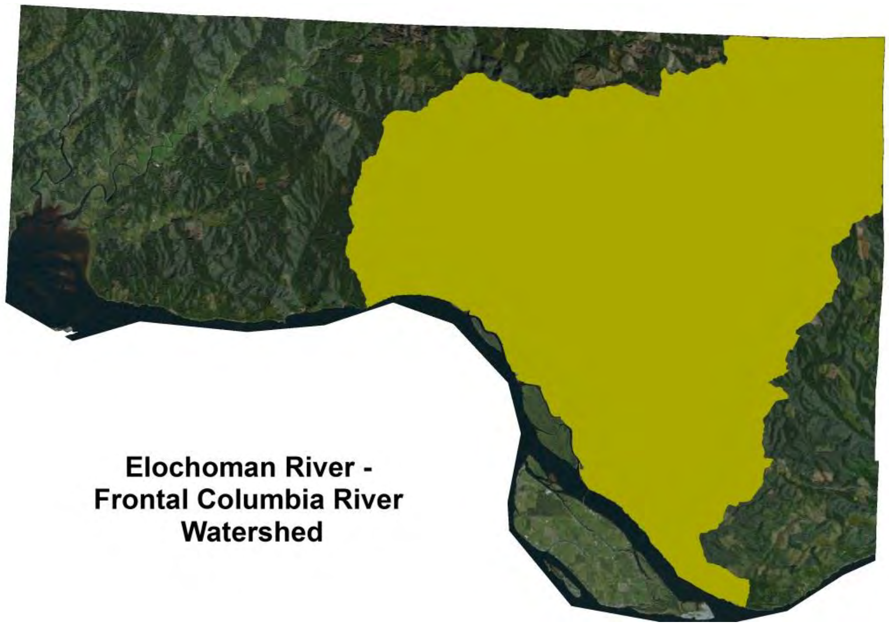


Figure 5.4 Grays River Watershed Ecosystem Analysis (Priority Areas)

5.4 Elochoman River – Frontal Columbia River



5.4.1 Physical and Biological Characterization

The entire Elochoman River – Frontal Columbia River watershed contains two major SMA jurisdiction waterways: Elochoman River and Skamokawa Creek. All floodplain, riparian, and upland SMA jurisdictional areas immediately adjacent to the Columbia River within the Wahkiakum County portion of the Elochoman River Watershed are summarized and described in the Cathlamet Channel Watershed (Section 5.5) since the resources, land use, and any impairments directly affect the Columbia River (Cathlamet Channel watershed). Map 6 in the Map folio generally shows the distinction between the watersheds, but Map 1 (Shoreline Jurisdiction) and Map 58 (Reaches) illustrates the relationship between the Columbia River and the adjacent SMA jurisdiction and reaches within the jurisdiction. The entire watershed consists of approximately 85,230 acres. The SMA jurisdiction covers about 3,761.97 acres of shoreline. The Elochoman River – Frontal Columbia River watershed is one of the fastest growing areas in the county, particularly in the Elochoman subbasin compared to the rest of the County. Pasture and agricultural land is slowly being converted to single family residential development.

The Elochoman River subbasin headwaters originate in the Willapa Hills of the coastal range. It has a drainage area of approximately 81.6 square miles with the highest elevation in the watershed of approximately 2,700 feet. The main stem of the Elochoman River flows within the eastern portion of Wahkiakum County south to its confluence with the Columbia River. Major tributaries of the Elochoman River include Nelson Creek, Beaver Creek, Duck Creek, Clear Creek, Rock Creek, West Fork, North Fork, East Fork, and Otter Creek. (LCFRB 2003) containing the following "shorelines of the state":

- Elochoman River (EFC_Reaches 1 – 11)
- North Fork –Elochoman River (EFC_Reach 1)

- West Fork – Elochoman River (EFC_Reach 1)
- East Fork – Elochoman River (EFC_Reaches 1 – 2)
- Otter Creek (EFC_Reach 1)
- Beaver Creek (EFC_Reaches 1 – 2)
- Nelson Creek (EFC_Reaches 1 – 3)

The Skamokawa Creek subbasin also originates in the Willapa Hills of the coastal headwaters west of the Elochoman subbasin. The drainage area is approximately 72 square miles (46,080 acres). The mainstem of Skamokawa Creek and its many tributaries flows through the south-central portion of Wahkiakum County to its confluence with the Columbia River near the unincorporated town of Skamokawa. Streams/rivers containing "shorelines of the state" include:

- Skamokawa Creek (EFC_Reaches 1 –11)
- West Fork – Skamokawa Creek (EFC_Reaches 1 -4)
- West Valley Creek (EFC_Reach 1)
- Left Fork - Skamokawa Creek (EFC_Reach 1)
- McDonald Creek (EFC_Reach 1)
- Standard Creek (EFC_Reach 1)
- Falk Creek (EFC_Reaches 1 – 3)
- Wilson Crek (EFC_Reaches 1 – 6)
- Dead Slough (EFC_Reach 1)
- Alger Creek (EFC_Reaches 1 – 5)
- Brooks Slough (EFC_Reaches 1 – 4)

In 1948 lower Skamokawa Creek was rerouted by the Army Corps of Engineers through a constructed channel as part of a flood mitigation project. The old streambed, named Dead Slough, was connected with the constructed channel by poorly functioning tide gates at each end. The tide gates prevented water from circulating through the channel, effectively destroying the historic channel's habitat functions, and preventing floodwater from leaving through the historic channel when it would overtop the constructed channel's dike. Recently, the tide gates were replaced by the Wahkiakum Conservation District and are now being actively used and managed to restore flows through the historic channel. Other hydrologic improvements were also made, including the replacement of two undersized culverts with bridges, and the strategic placement of large woody debris. Together the improvements and ongoing management provide enhanced fish habitat and allow floodwaters that overtop the constructed channel dike to ebb & flow through the historic channel more quickly than they previously did. The project showcases the results of collaborative work between agencies and local landowners to achieve multiple benefits.

Seasonal stream flow reflects the precipitation patterns in the watershed. The "flashy" nature of the subbasins is due in part to the topography of the basin as well as the natural and man-made alterations to the waterways in the watershed. In addition, all but the upper reaches of the basin are considered hydrologically immature (Wade 2002) which suggests that geomorphic and sediment movement is unstable and will continue to see changes. As a result, both elevated peak flows and low flows are considered limiting factors in the Elochoman River and Skamokawa subbasins (LCFRB 2003 and Wade 2002).

Peak flows are associated with fall and winter rains and low flows typically occur in late summer in this region. Flows in the Elochoman River average 327,815 acre-ft./year (452.8 cubic feet per second (cfs)), with a maximum of 8,530 cfs and a minimum of 9.8 cfs (LCFRB 2010b and LCFRB 2001). Skamokawa Creek is estimated to have a mean annual flow of 332,476 acre-feet/year (459 cfs) (LCFRB 2001).

Land uses in the watershed, described in more detail in section 5.4.2, have resulted in modification of the floodplains and waterways along Elochoman River and Skamokawa Creek. The major issues as a result of the modification include stream bank erosion and mass wasting. The erosion of stream banks largely resulted from the development of agricultural and logging activity. Wahkiakum Conservation District (WCD) conducted surveys in the mid-1990s that revealed over 90 percent of the reaches on the mainstem Skamokawa had less than 10 percent actively eroding stream banks. Surveys in 1991 in the middle reaches of the Skamokawa revealed that 28 percent of surveyed banks were eroding; 34 percent in areas of agricultural use (Ludwig 1992). Bank erosion is higher in these areas due to incision, alluvial soils, and a lack of vegetation on the stream banks. Bank stability in the Elochoman subbasin is generally in good condition. Some road related erosion exists on the mainstem and some bank cutting and incision problems occur on the West Fork and on Nelson Creek and its tributaries. Updates to the Washington Forest Practices Act as well as work by some landowners in partnership with the Wahkiakum Conservation District

Mass wasting events are seen as a bigger problem in the Elochoman subbasin than in the Skamokawa subbasin. In the West Fork, mass wasting is often associated with roads. In the North Elochoman basin, 205 of 383 surveyed landslides were related to forest practices activities (WDNR 1996 and LCFRB 2010b). Diking, roads/railroads, and channel incision in agricultural areas limit side channel development in the Elochoman watershed, however, some portions of the Elochoman, in particular the West Fork, have abundant side channels. (LCFRB 2010b).

Land cover types have also changed dramatically as a result of land use activity. Table 5.14 summarizes National Land Cover Data (NLCD 2011) within the watershed. Forest and woodland land cover dominate the watershed although late-seral stage forests are virtually non-existent. Overall, there has been a decrease in vegetative cover in the Elochoman River – Frontal Columbia River watershed, with potential impacts to runoff properties. Approximately 72 percent of the watershed is either in early-seral stage forests, is cultivated land, or is developed land. Developed and cultivated land occurs primarily in the floodplains of the Elochoman River and Skamokawa Creek subbasins. Mixed forest and non-forest/logged cover are the predominant land cover in the basin (total of 63 percent). Aerial imagery (NAIP 2012) shows areas at different seral stages post-logging throughout the watershed. High road densities are also a concern, with road densities greater than five miles/mi^2 throughout most of the watershed. Forest and road conditions have potentially altered flow regimes (LCFRB 2010b). See the Land Cover map (Map 44) in APPENDIX E.

Table 5.14 Elochoman Watershed Land Cover

Land Cover Type	Acres	percent
Agriculture	5068.44	5.95

Aquatic Vegetation	1.56	0.00
Developed	436.15	0.51
Forest and Woodland	53440.03	62.71
Nonvascular & Sparse Vascular Rock Vegetation	0.00	0.00
Open Water	313.00	0.37
Recently Disturbed or Modified	25667.65	30.12
Shrubland & Grassland	293.44	0.34
Total	**85,220.26**	**100.00**

Source: NLCD 2012

Wetlands and Floodplains

The structure and function of wetlands play an important role in the ecosystem processes that contribute to the Elochoman River, Skamokawa Creek and the Cathlamet Channel of the Columbia River.

The majority of the wetlands in the Elochoman River – Frontal Columbia River watershed are located, as larger tracts of land, in the lower portion of the watershed along the Columbia River between Skamokawa Creek and the Elochoman River (See the NWI Wetlands map (Map 24) in APPENDIX E). Much of these wetlands occur on the Julia Butler Hansen National Wildlife Refuge. The shoreline reaches along the Columbia River are considered to be within the Cathlamet Channel – Columbia River watershed, but wetlands inland of the shoreline, are considered part of the Elochoman River – Frontal Columbia River watershed. Isolated wetlands occur throughout Skamokawa Creek and Elochoman River subbasins. See Table 5.15 for a summary of wetland areas in the watershed. The largest concentration of wetlands in the area occurs in four locations :

1. Lower West Fork of Skamokawa Creek and subsequent (non-SMA jurisdiction) tributaries. The majority of wetlands in this area are riverine freshwater emergent wetlands.
2. Area between the mainstem of the Columbia River, SR 4, Skamokawa Creek and the Elochoman River. Most of this area is USFWS land (Julia Butler Hansen National wildlife refuge). The majority of the wetland types consist of riverine freshwater emergent wetland. Much of the area, to some degree, is shaped by the ebb and flood cycle of the tides.
3. Main stem of Elochoman River within approximately three miles of the mouth and are largely forested/shrub wetlands.
4. Nelson Creek, an Elochoman river tributary in the lower subbasin, within approximately one mile of the mouth of Nelson Creek and all within approximately three miles of the mouth of the Elochoman River. Wetlands in this area are dominated by riverine freshwater emergent wetland types (LCFRB 2003).

A large tract of land in this area is owned by the Columbia Land Trust. An approved restoration project has been planned to re-connect the hydrology through box culverts under SR 4 just south of the Elochoman.

The Elochoman River is diked on both sides of the river for the first 1.4 miles from the mouth. Nelson Creek is also diked and largely incised due to a long history of livestock grazing in the region. The system of levees along with stream adjacent roads and railroads limit floodplain connectivity. There is high entrenchment within areas of agricultural use. Middle reaches of the Elochoman River are entrenched due to the use of splash damming (Wade 2002 and LCFRB 2010b). Floodplain connectivity improves in the upper watershed.

The floodplains along Skamokawa Creek and its tributaries have largely been converted to developed open space and agriculture. In the lower and mid-Skamokawa Creek, the system of levees prevents floodplain connectivity. The lower reaches of tributaries have been diked and are also entrenched in areas of agricultural use. Alger Creek has been diked along the first 1,700 feet. Additionally, part of the waterway in the lower reaches has been diverted from its natural meandering channel into a straightened channel from the mouth to RM 1.7. From RM 1.7 to 6.6, the creek is entrenched as it flows through agricultural land. Floodplain connectivity increases in the upper watershed. (LCFRB 2010b).

Table 5.15 Wetlands in Elochoman River watershed

Associated Wetlands	Acres	percent Wetlands of total Watershed
Freshwater Emergent Wetland	2948.17	3.46
Freshwater Forested/Shrub Wetland	2183.14	2.56
Freshwater Pond	72.16	0.08
Floodplain	6254.61	7.34
Total Watershed Area	**85244.08**	

Source: NWI 2012, WBD NHD 2013

Aquifer recharge areas

The most productive ground water yields within Elochoman River, like the aforementioned watersheds, occur in/on the unconsolidated to poorly consolidated sediments of the Alluvium and Older Alluvium units (Weigle and Foxworthy, 1962; Myers 1970; WADOE 1972; Sweet and Edwards 1983; Piechowski and Krautkramer, 1998) that occur within the major river and stream valleys (Elochoman River and Skamokawa Creek). Most wells along the Elochoman River and Skamokawa Creek that have high groundwater yields (300 to greater than 3,000 gpm) are completed within these units.

The hydraulic characteristics of the unconsolidated to poorly consolidated sediments of the Alluvium and Older Alluvium deposits are highly variable and dependent on the geologic source of the sediments, mode of deposition, and thickness (LCFRB 2001). The alluvial deposits in the Elochoman River watershed can be generally divided into 2 categories, based on primary sediment-source region. See Table 5.16 below.

5.16 Extent of main aquifers by sub-basin

	Geologic Units	
Subbasins	**Alluvium and Older Alluvium (Acres)**	**Columbia River Basalt Group (Acres)**
WRIA 25		
Skamokawa Creek	5,587	3,230
Elochoman River	2,891	11,802

Source: LCFRB 2001

The Critical Areas Map (Map 14) in APPENDIX E shows likely areas where aquifer recharge areas may occur. In this watershed, aquifer recharge areas occur on geological units that are known for having a high to moderate rate of permeability. Other important areas, such as wetlands, streams, and water and resource protection well information, are also used to identify potential recharge areas. Much of Skamokawa Creek and the Elochoman River, the 100-yr floodplain and tributaries to these waterways are likely areas for aquifer recharge. The majority of the water and resource protection wells occur along the shoreline and in immediate upland areas adjacent to Skamokawa Creek, the Elochoman River and their major tributaries.

Fish and Wildlife Habitat

The Elochoman River –Frontal Columbia River watershed provides a variety of upland, wetland, riparian, and in-stream habitat for a variety of species. The Washington Department of Fish and Wildlife has identified priority habitats & species (PHS) for a variety of species, primarily salmonids in Skamokawa Creek and Elochoman River subbasins and can be viewed in the PHS map in (Map 26) APPENDIX E. The Elochoman River – Frontal Columbia ecosystem supports a wide variety of fish and wildlife in addition to listed Endangered Species Act (ESA) species (LCFRB 2010b). See APPENDIX F for a list of species, and their scientific names, found in Wahkiakum County. Further discussion of salmonid habitat in these subbasins is described below. Additionally, Elk priority habitat has been identified throughout the watershed. Sightings of marbled murrelets have occurred in the Upper Skamokawa Creek region. Other species such as Columbia white-tailed deer, waterfowl, cavity-nesting ducks, bald eagles, osprey, and a variety of amphibians and a number of fish species utilize wetland and floodplain areas throughout the watershed.

The Washington State Conservation Commission performed a Limiting Factors Analysis (LFA) and LCFRB (2003 and 2010b) as well as WDFW's salmonscape (2011) identified salmonid species present in the Elochoman River and Skamokawa Creek subbasins. Local ESU salmonid stocks include: fall Chinook, chum, coho, and winter steelhead. Returns of fall Chinook and winter steelhead include both natural and hatchery produced fish (LCFRB 2003 and Wade 2002). However, the Elochoman basin contains important habitat, particularly in the lower tidal reaches, for all 13 listed Columbia River Salmonid Evolutionary Significant Units (ESUs) and Pacific eulachon

(*Thaleichthys pacificus*) and green sturgeon (southern DPS) which have been known to utilize the tidal reaches of the river and stream systems in the watershed.

Additionally, habitat-based assessments were completed for fall Chinook, chum, coho, and winter steelhead in the Elochoman and Skamokawa watersheds. In the Elochoman, adult productivity for all four species has been reduced to 17-42 percent of historical levels. Declines in adult abundance level have also been significant for all species, with the greatest decline seen for chum and coho (LCFRB 2010b). Current adult abundance of chum and coho is estimated at only seven percent and 39 percent of historical levels, respectively (LCFRB 2010b). Abundance of both fall Chinook and winter steelhead in the Elochoman has declined by approximately 66 percent (LCFRB 2010b). Diversity (as measured by the diversity index) has remained steady for fall Chinook, but has declined by 20-50 percent for winter steelhead, coho and chum (LCFRB 2010b).

Salmon and steelhead numbers have significantly declined compared to their historical levels in the watershed. Extinction risks are significant for all salmonid species – the current health or viability is low for all four anadromous species. Returns of fall Chinook, coho, and winter steelhead include both natural and hatchery produced fish. Other species of interest in the Elochoman River – Frontal Columbia River watershed include coastal cutthroat trout and Pacific lamprey. These species have been affected by many of the same habitat factors that have reduced numbers of anadromous salmonids (LCFRB 2010b). The Elochoman River hosts all 13 listed Columbia River Species. Species known to migrate and spawn in the Elochoman and its tributaries are identified in Table 5.17.

The upper Skamokawa and tributaries provide potentially productive habitat for all species. Wilson Creek primarily supports winter steelhead and coho. Skamokawa Creek also contains populations of chum salmon. The upper and lower reaches are impacted by agriculture and rural residential development. Effective recovery measures will include riparian reforestation, targeted cattle exclusion fencing, and floodplain reconnection. (LCFRB 2010b)

Table 5.17 Salmonid presence in the Elochoman River subbasin

Fish Presence in the Elochoman River Subbasin		
Species	**Location**	**Life History and Timing**
Fall Chinook (Tier 2)	• RM 2.1 to Elochoman Salmon Hatchery • Downstream of RM 4.0 (weir) • RM 3.0 to 6.5	• August – November: freshwater return; in -migration • October – December: spawning • October – February: egg incubation • February- April: early rearing • March – June: rearing • July – November: ocean entry; out-migration
Coho (Tier 3)	• Spawn in mainstem, W. and E. Forks of Elochoman • Beaver, Duck, Otter Creeks	• August – November: freshwater return; in -migration • October – January: spawning • October – March: egg incubation • March – May: early rearing • March – May (1+ years): rearing • May – June: ocean entry; out-migration
Coastal Cutthroat (Tier 3)	• Access to most of Elochoman watershed except Beaver Creek, Duck Creek, and upper tributary reaches	• June – October: freshwater return; in -migration • December – May: spawning • January – June: egg incubation • May – June: early rearing • January – March (2+ years): rearing • March – July: ocean entry; out-migration
Winter Steelhead (Tier 4)	• N/A	• November – March: freshwater return; in -migration • December – May: spawning • December – June: egg incubation • July – August: early rearing • September – June: rearing • June – July: ocean entry; out-migration

Source: LCFRB 2003

In the Skamokawa and Elochoman subbasins pool habitat is less prevalent in the lower reaches where agriculture uses dominate and was more prevalent in the upper forested reaches. Pools were noted as often associated with log jams (Wade 2002 and LCFRB 2010b).

Waterstrat (1994) summarized three riffle-pool surveys conducted in the Skamokawa, and Elochoman watersheds. It was found that of the three surveys, 94.5 percent, 74 percent, and 78 percent of riparian areas are in "poor" condition, respectively. Nearly all of the subbasins are at least 95 percent commercial and state timberland and were heavily harvested in the mid-20th century (Waterstrat 1994). In most cases, poor riparian areas are found in the lower river segments due to the impacts of agriculture, livestock grazing, roads, and diking on buffer widths and species composition. Upper reaches tend to suffer from young timber stands, and to a lesser extent, high deciduous composition. Poor riparian conditions in the Elochoman watershed have also been attributed to mass wasting and debris flows (DNR 1996 and LCFRB 2010b).

The Skamokawa watershed also has poor substrate fine conditions. This is attributed to steep slopes underlain with sedimentary rock that are prone to landslides (Ludwig 1992). The Wilson Creek and West Fork Skamokawa watersheds have the highest and second highest mass failure rates per square mile in Wahkiakum County, respectively (Waterstrat 1994). The lower reaches of the mainstem and tributaries tend to have the highest levels of fines. Levels of fines decrease as gradient increases. In the Elochoman watershed, substrate conditions are highly variable depending on the seasonal precipitation, mass wasting, and erosion events. Fines are generally high in the mainstem and in the lower reaches of tributaries. Gravel content increases as gradient increases. Especially high numbers of reaches in the Nelson Creek and North Fork Elochoman have elevated substrate fine conditions (WCD surveys, Wade 2002). (LCFRB 2010b). Elk Horn Creek is a major source of sediment to Wilson Creek and Skomokawa Creek. (WDFW personal comments 2015)

The Skamokawa watershed was also rated as poor for LWD availability. Where wood does exist it is typically small and deciduous. Standard and McDonald Creeks have good LWD and recruitment potential, however, some areas have no wood whatsoever. The Elochoman had over 85 percent of reaches rated as poor for LWD. LWD is non-existent in many reaches and the number of large ("key") pieces is declining. Most of the wood that does exist is in natural log jams. The majority of reaches with decent LWD quantities are in the upper reaches. The West Fork Elochoman watershed has a few segments with good LWD conditions (WDNR 1996, LCFRB 2010, CREST 2006). See the LWD limiting factors map (Map 63) in APPENDIX E. (WDFW personal comments 2015)

Frequently flooded areas
In general, flooding is the result of erosion, aggradation, and overbank flows. Erosion is common in the middle portions of Skamokawa Creek and the Elochoman River between the high gradient slopes and low gradient tidally affected areas. Flood events can affect erosion forces in these areas. Highly erodible soils combined with ground disturbing activities (i.e. logging and road-building) can destabilize slopes resulting in slope failures (WCFHMP 2006). Figures 3.2-3.4 in Section 3.2.5 shows the approximate location of flooding-related issues throughout the County.

In the Elochoman River subbasin, the most downstream portion of the basin has the widest floodplain areas. In the upper reaches of the Elochoman River and the tributary streams, the valleys and the associated floodplains are in general not as wide as in the lower valley, so there is less area that is regulated as floodplain. In areas where there is a broad floodplain, the floodplain acts as a natural storage area for floodwaters which results in lower peak flows from floods (LCFRB 2003). See the Preliminary Shoreline Jurisdiction map (Map 1) and Map 17 that shows the 100-year floodplain in APPENDIX E.

FEMA data suggests much of the SMA shorelines are within the 100-year floodplain in both Skamokawa Creek and the Elochoman River (see Flood Hazard map (Map 17) in APPENDIX E). Elochoman River also has a designated floodway near the mouth of the river (FEMA 1996 and CREST 2006) New data from the US Army Corps of engineers has updated flood data for the lower sections of Skamokawa Creek and the Elochoman River (USACE 2012) which provides finer resolution flood data for these waterways and provide updated draft flood data to FEMA.

On Skamokawa Creek, a canal was constructed to divert flow away from the historic channel. Installed tidegates created an artificial meander. Pump stations were also installed in 1977 on Brooks Slough on the USFWS NWR to control flooding on the refuge. Diking projects have also been constructed on the creek. Many of the flood control structures are in need of repair, as identified by the Wahkiakum County Comprehensive Flood Hazard Management Plan (CREST 2006). Tide gates at Steamboat Slough were replaced in 2009.

Geologically hazardous areas

In both the Skamokawa Creek and Elochoman River subbasins, the middle and upper reaches are more closed in by the surrounding hills. The shorelines in these sections have a moderate to high risk of landslide hazards. Lower in the subbasins, the basin gradient is gentle and surrounding hills are buffered by a larger floodplain (Landslide hazard map (Map 19) in APPENDIX E). Ecological processes related to geology include geomorphic processes such as the interaction of water, sediment and creates channel and shoreline structure. This includes bank and bed erosion, channel migration and evolution, sedimentation, debris input, and accretion. Geologically hazardous areas, such as landslide areas contribute to natural sediment inputs that create habitat and carry nutrients downstream.

Highly erodible soils combined with ground disturbing activities in the middle subbasins can result in slope failures along the shorelines. Ground disturbing activities include logging and road-building, which are common in the upland areas of the upper and middle portions of the subbasin (WCFHMP 2006).

Liquefaction hazards are high to moderate in large sections of the floodplains between Skamokawa and Elochoman basins along the Columbia River and lower Skamokawa Creek and Elochoman River basins. See the Liquefaction map 21 in APPENDIX E. High risk of liquefaction hazards generally occur between Skamokawa and the Town of Cathlamet and occur further up the subbasins of Skamokawa Creek and Elochoman Rivers where floodplains exist (Liquefaction map in APPENDIX E). Isolated pockets of moderate to high liquefaction hazard areas exist in small pocket wetland and floodplain areas within the subbasins (CREST 2006).

5.4.2 Land Use and Shoreline Modifications

Forestry is the predominant land use in the Elochoman/Skamokawa Watershed. See Land Use map (Maps 50 and 51) in APPENDIX E for land use data from 2010. Extensive logging occurred in the past without regard for riparian and in-stream habitat. This has resulted in sedimentation of salmonid spawning and rearing habitat (LCFRB 2010). Most of the forest cover is in late-seral stages, however, as the forest matures, watershed conditions are recovering (LCFRB 2010b).

Forest practices in the watershed have resulted in high road densities. The road network has critical implications for watershed processes such as flow, sediment production, and the transport of contaminants. Road density in the Elochoman watershed varies, but it is estimated to be similar to that of the Wallacut watershed (approximately a high 5.14 miles/miles^2) (LCFRB 2010b). Land cover and land use in the Elochoman watershed is presented in Table 5.14 and Table 5.18, respectively.

Agriculture and residential land use is located along lower alluvial stream segments of the Elochoman River and Skamokawa Creek. The watershed is primarily in private ownership, as shown in the Public Access map (Map 56) in APPENDIX E. The bulk of the private land is currently industrial forestland. However, some agricultural land in the Elochoman valley has been subdivided and converted to smaller residential lots (Cowlitz-Wahkiakum Council of Government 2008).

The mainstem of Skamokawa contains a relatively broad valley where land use is predominantly agricultural. As a result, there have been considerable agricultural impacts to fish habitat in these areas. Elochoman and Skamokawa also suffer from non-forested riparian zones and disconnected floodplains due to the establishment of levees, tidegates and agricultural production.

A similar land-use pattern can be found in the Elochoman watershed, with the exception being that the agricultural valley is found primarily only along the mainstem. The species effects are also similar, with agricultural uses having the greatest impact on chum and fall Chinook spawning and rearing as chum and chinook tend to migrate to and spawn lower in the watershed where agricultural and livestock actions would have a greater impact. Forest practices have the greatest effect on winter steelhead and coho because coho and steelhead often spawn in the upper reaches of the watershed where logging impacts would have a greater impact.

Most of the agricultural development (nine percent of total land cover in the watershed) and floodplain areas occur in the lower reaches of the watershed. Logging, hatchery, and livestock uses occur primarily in the middle and upper portions of the subbasins.

The population for unincorporated areas in WRIA 25 is expected to grow 37 percent from 2000 to 2020 and is focused largely in the Elochoman valley and Puget Island (LCFRB 2001) (See Section 5.5 for discussion about Puget Island). Population projections for the draft Wahkiakum County Comprehensive Plan (2008) and the Washington Office of Financial Management support these numbers. Continued population growth will increase pressures for conversion of forestry and agricultural land uses to residential uses, with potential impacts to habitat conditions (LCFRB 2010).

Shoreline modification in the Elochoman Watershed include reinforced banks, flow modification (rechanneling a section of Elochoman River), pile dikes, and levees in the lower portions of Skamokawa Creek and the Elochoman River. Additionally, the Elochoman River is used as a domestic water supply for the Town of Cathlamet. The intake is located at approximately RM four (LCFRB 2010). A summarized view of shoreline modifications (Map 49) can be viewed in APPENDIX E.

Table 5.18 Land use in Elochoman River watershed

Land Use	Acres	Percent of Acres in Elochoman Watershed
Agriculture	3,192.90	3.78
Cultural	1.73	0.00
Fishing Activities	1.52	0.00
Forestry	75,052.82	88.95
Government	55.61	0.07
Lodging	16.78	0.02
Manufacturing	1.15	0.00
Non Commercial Forest	72.61	0.09
Open Space	3,032.34	3.59
Parks	10.49	0.01
Residential (Misc.)	13.65	0.02
Residential (Multi-Family)	66.11	0.08
Residential (Single-Family)	1,470.58	1.74

Resource Production	96.02	0.11
Retail	25.28	0.03
Transportation	0.74	0.00
Undeveloped	1,263.95	1.50
Utilities	2.42	0.00
Total	**84,376.71**	**100.00**

Source: Ecology 2010

5.4.3 Public Access Opportunities

Several public access opportunities have been identified within the Elochoman Watershed. Skamokawa Vista Park provides over 70 acres of a full service campground along the Columbia River. Boat launch facilities, hiking trails and views of the Columbia River can all be found at the park. Brooks Slough Boat Launch located at Milepost 39 on SR 4, this 2.5 acres site hosts a small, primative boat launch with limited parking. The Lower Columia River Water Trail can be used to explore the Wildlife Refuge. The Wahkiakum County Fairgrounds & Day Use Park are located adjacent to Skamokawa River, across the river pedestrian bridge and across SR 4 from Vista Park.

In the upper Elochoman River, there are two locations available for public fishing access, but there is no boat launch. Another access opportunity is the entry point within this watershed to the Julia Butler Hansen NWR. Further discussion of existing and potential public access opportunities are described in Section 6.1.3. Existing public access areas can be viewed in APPENDIX E (Map 56)

5.4.4 Restoration Potential and Considerations

Section 5.1.4 discusses how Important Areas and Impaired Areas were identified and compared. The same methodology was utilized for the Elochoman River watershed. The Elochoman River Basin contains several locations that have both high ranked "Important Areas" and high to moderate level of impairment. See Figures 5.5 and 5.6 respectively. Much of the high ranking "Important Areas" are in the floodplains of Skamokawa Creek, Elochoman River and their tributaries, where, subsequently, much of the development and impaired areas occur. The Wahkiakum/Cowlitz Conservation District has performed several restoration projects throughout the basin. The Conservation District has largely focused their efforts in Skamokawa Creek basin, forming a watershed partnership consisting of private landowners throughout the basin and has more recently been focusing attention to the lower and Upper Elochoman River. In both cases, the Conservation District has been working with landowners to plan, fund and implement salmon recovery efforts. Additionally, CLT is working on a project in conjunction with the Conservation District on Nelson Creek. The reach matrix in APPENDIX A also suggests potential restoration opportunities on a reach by reach basis (also, see Appendix E Map 58). Table 5.27 in Section 5.7 describes management recommendations based on the ecosystem-wide analysis and suggests potential management options for each recommendation. The following is a summary of the Ecosystem Analysis for Skamokawa Creek and Elochoman River subbasins of this watershed:

Skamokawa: According to the ecosystem analysis, much of the Skamokawa subbasin (including areas along SMA tributaries) have a moderate to high level of impaired ecosystem processes. Much of this is due to a combination of a relatively flashy river system along with upland forestry, degraded floodplain and riparian quality. Land use in the subbasin is largely agricultural, with forestry in the headwater region. Rural residential development is also prevalent. Denuded native vegetation along the riparian corridors along with high flows has increased erosion rates in some areas, particularly in Skamokawa Creek (Reaches 4-8), Wilson Creek (Reaches 5-6), West Valley Creek, and along the West Fork of Skamokawa Creek. Other highly impaired areas include Brooks Slough and Alger Creek.

Priority Restoration/Protection areas include the area between Dead Slough and Skamokawa Creek as well as the floodplain and upland forested area between lower West Fork of Skamokawa Creek and the mainstem of Skamokawa Creek. High priority restoration areas occur on Skamokawa Creek between Reaches 4 and 7 and on the West Fork between reaches 2 and 4. Several areas have culverts and water control structures that, if improved, could provide nutrient cycling, connection to food web systems, improved sediment transport and a change in hydraulic regimes that ultimately may improve habitat conditions, riparian plant species and water quality. Some of these impaired areas have already been addressed, such as the Dead Slough reconnection project to the mainstem of Skamokawa Creek described below.

The Lower Columbia Fish Recovery Board and the Wahkiakum Conservation District have planned and pursued many projects in the watershed in both Skamokawa Creek subbasin and the Elochoman River subbasin including the projects described below.

The Skamokawa Community Watershed Project is a community based project facilitated by the Conservation District that has completed several projects in the basin with willing landowners including the restoration of five sites on Skamokawa Creek to reduce erosion, improve water quality and increase habitat diversity and quality. Large wood was placed in 3.5 miles of the creek to stabilize banks and improve salmon habitat. Native trees and shrubs were planted on 88 streamside acres. The project improves habitat for Chinook, coho and chum salmon, steelhead and cutthroat trout.

A large scale project in the subbasin includes the recently completed tidegate replacement project that hydrologically reconnected Dead Slough, the original Skamokawa Creek channel, to the current creek channel. The project has almost immediately improved water quality, provided increased hydrologic connectivity and increased fish passage to almost five miles of previously disconnected instream habitat.

Additionally, the Skamokawa Community Watershed Project, with help from WSU Extension, utilized resources from LCRFRB and the County Noxious Weed Program to control the Japanese knotweed infestation (a recurring community resource concern) to improve riparian function. In most areas where the invasive is established the magnitude of the infestation is simply beyond the individual landowners comfort level and ability to manage. The riparian restoration project confirmed the extent and magnitude of invasive species and is currently implementing treatments to manage populations, establish native forest riparian species, and educate landowners regarding continued monitoring and treatment for invasive species management. The project builds upon the extent and occurrence data identified in the Wahkiakum County Noxious Weed Survey Project (CLT 2011). The project is intended to manage knotweed along 23 miles of stream or 56 miles of streambank. Details on this and other projects in the subbasin can be viewed on the Washington State Project Information System (PRISM) at http://www.rco.wa.gov/prism_app/about_prism.shtml.

Elochoman: In the Elochoman subbasin, near the mouth, the ecosystem analysis found that the floodplains in this area rank high in importance and are moderately to highly impaired. A restoration project implemented by the Washington Department of Transportation and CLT has been approved to replace culverts under SR 4 and improve fish access to floodplain habitat. The project was originally planned for 2014 but has been delayed due to unknown constraints. Additionally, areas in and around reach five of the Elochoman River (EFC_Elochoman_05) are highly impaired, but the area is also considered to rank high as an important area for ecosystem-process, therefore a priority for restoration efforts.

The strategies below are intended to identify limiting factors that inhibit ecosystem structure and function and protect and/or enhance habitat quality.

Priority habitats in the Elochoman River Subbasin are located primarily in the upper reaches of the Elochoman River mainstem and associated tributaries. Wade (2002) identified several focus areas that should be protected. These areas include:

- Side channels in the upper segments of Wilson, Falk, and Left Fork Skamokawa Creeks provide critical habitat, which currently are considered to have generally low to moderate impairments, but has some smaller places with high or very high ecosystem impairments according to the ecosystem analysis described in Appendix D. Generally these areas have a rating of requiring some level of protection, a few small areas of restoration. Areas along Wilson creek are rated for Development/Restoration
- Floodplain habitats are limited and need protection wherever they occur. Particularly in the West Fork area (reaches 2-4) where there is a high impairment rating according to the ecosystem analysis described in Appendix D.
- Standard Creeks contain some of the best and most productive habitat for steelhead in the subbasin and should be protected.
- Identify and protect cooler water refuges such as Falk Creek, which is currently rated for protection and/or restoration according to the ecosystem analysis described in Appendix D.

Specific issues identified in the LCFRB 2003 and Wade 2002 reports that impact the needs of fish include:

- Reduce road densities and direct connections between road drainage ditches and streams to reduce peak flows, promote groundwater recharge, and potentially enhance low summer flows.
- The dikes, stream adjacent roads, and entrenchment limit floodplain connections along the Elochoman River. (LCFRB 2003 and Wade 2002).

Additionally, culverts and tidegates block 10 percent of presumed anadromous habitat on Skamokawa Creek. A tidegate and a few culverts need assessment on Alger and Risk Creeks (a non-SMA stream and tributary to Brooks Slough). There are several fish passage barriers on Birnie Creek including a fish screen associated with a high school fish-rearing pond at the mouth of Birnie Creek. There are also many passage barriers associated with culverts in the Elochoman watershed.

The hatchery intake near Beaver Creek may also be a problem for migrating salmonids and other fish species. (Wade 2002 and LCFRB 2010).

Sediment production from existing and new private forest roads is expected to decline over the next 15 years as roads are updated/required to meet the new forest practices standards, which include the disconnection of drainage lines along the side of roads from streams when culverts are upgraded. The frequency of mass wasting events should also decline due to the new regulations, which require geotechnical review and mitigation measures to minimize the impact of forest practices activities on unstable slopes (LCFRB 2010).

The Lower Columbia Fish Recovery Board has funded and tracked several projects in the watershed including planned, funded, unfunded, and completed projects. Restoration projects affiliated with the Lower Columbia Fish Recovery Board can be viewed by visiting http://www.lowercolumbiasalmonrecovery.org/mappage;jsessionid=B8CC8399D98CD82034478EB1B54D0FB9. The map shows information on projects by reach. These reaches, somewhat correspond with the reaches identified for Wahkiakum County-Town of Cathlamet SMP update. However, project based reaches often emphasize a specific goal or need that sometimes does not overlap with the criteria used for determining the reach breaks in this SMP update.

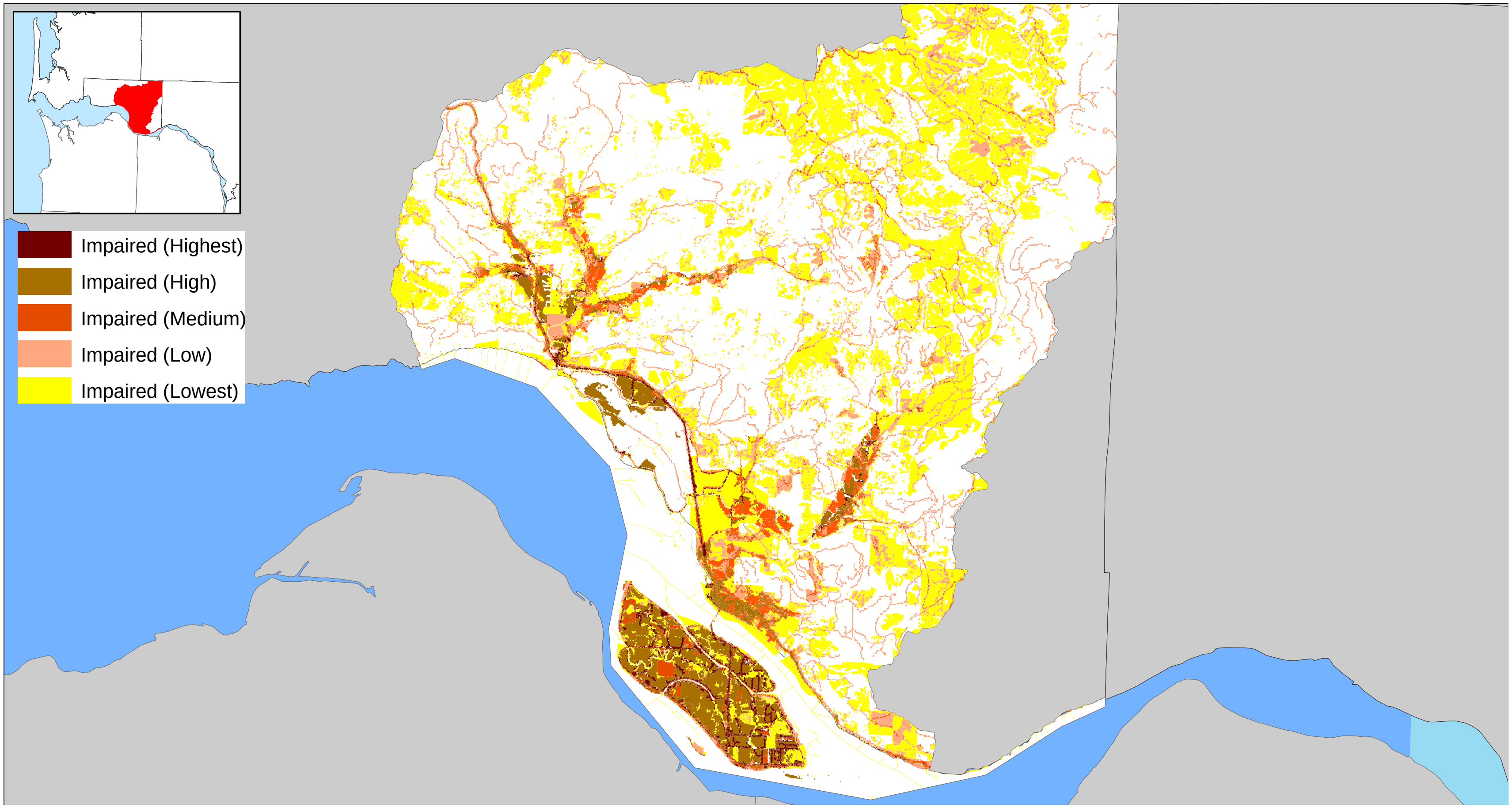


Figure 5.5 Elochoman River and Cathlamet Channel Watersheds: Ecosystem Analysis (Impaired Areas)

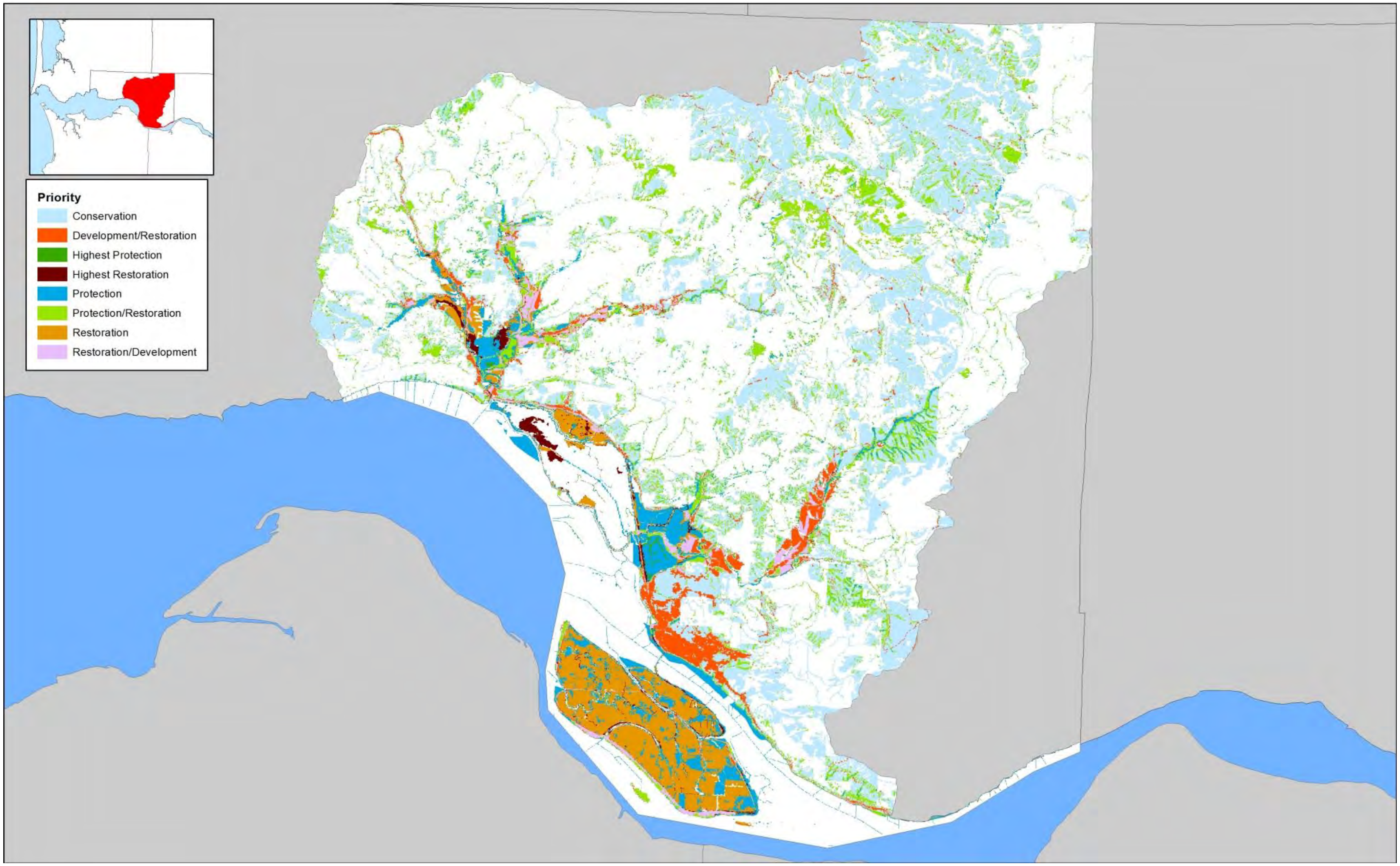


Figure 5.6 Elochoman River and Cathlamet Channel Watersheds Ecosystem Analysis (Priority Areas)

5.5 Cathlamet Channel – Columbia River

5.5.1 Physical and Biological Characterization

The Cathlamet Channel/Bay – Columbia River watershed covers the mainstem of the Columbia River that is upriver from the Baker Bay – Columbia River watershed. Beginning at approximately River Mile 30.5, east of Jim Crow Creek, the watersehd extends upriver into Cowlitz County (approx. RM 51.5). The Cathlamet Channel watershed in Wahkiakum County overlaps both the Lower Columbia River and Columbia River Estuary provinces. The upland extent of this watershed is generally defined by the OHWM and covers in-water areas within the River.

However, for the purposes of this report, the SMA jurisdictional area immediately adjacent the Columbia Riveris described in this Section while areas further upland in the Elochoman and Germany Creek watersheds are described separately in those sections (5.4 and 5.6 respectively). The Town of Cathlamet, while mostly located in the Elochoman watershed, is described here with it's jurisdictional shoreline along this Cathlamet Channel watershed to reflect how inextricably linked the town and its waterfront are. Additional description of upland factors that influence the Town and its shorelines can be found in Section 5.4.

Analysis for this characterization report only covers the watershed area within Wahkiakum County. Streams/rivers considered "shorelines of the state" in the County's and Town's portion of this watershed include:

- Columbia River (CC_Reaches 1 – 20)
    - Town of Cathlamet (CC_Reaches 9 – 12)
- Price Island (CC_Reach 1)
- Hunting Island (CC_Reaches 1 -6)
- Ryan Island (CC_Reaches 1 – 5)
- Puget Island (CC_Reaches 1 -3)

- Little Island (CC_Reaches 1 – 3)
- Brown Island (CC_Reach 1)
- Jackson Island Complex (CC_Reach 1)
- White Island Complex (CC_Reaches 1 – 5)
- Coffee Pot Island (CC_Reaches 1 -2)

The County portion of the watershed contains approximately 13,400 acres, of which the Town portion is approximately 11.6 acres. The SMA shoreline area constitutes approximately 1,881 acres (approximately 85 acres for the Town) and includes open water, shallow subtidal habitat, intertidal habitat and various floodplain and upland habitat. Thirteen federally listed species that migrate through the Columbia River use this shoreline area, including eleven species of steelhead and salmon, green sturgeon, and Pacific eulachon.

Columbia River Mile 34 lies at about the mid-point of Price Island and serves as a dividing point for upriver and downriver conditions. The western portion of the Cathlamet Bay watershed is part of the Columbia River Estuary (area downstream of RM 34) that contains salinity influence from the ocean. The eastern extent of this salinity influence is near the eastern point of Puget Island (~RM 46). Skamokawa Creek, Elochoman River, and other smaller, non-SMA streams all flow into the Cathlamet Channel (Shoreline Jurisdiction map (Maps 1 and 2 in APPENDIX E). Much of the agricultural and developed areas (confluences of the Elochoman and Skamokawa and the NWR are levied (See Shoreline Modifications map (Map 49) in APPENDIX E). The remainder of the Cathlamet Bay – Columbia River watershed, including the Town of Cathlamet waterfront, is considered to be the Lower Columbia River (section of river upstream of the estuary) (Johnson et al. 2003b). Tidal influence affects the entire watershed as well as streams and tributaries in the subbasins that flow into the Cathlamet Channel - Columbia River watershed. Map 17 in APPENDIX E shows the tidal influence extent (head of tide) in Wahkiakum County.

The Columbia River Estuary is a high energy system with complex and dynamic interactions between river and tidal forces. However the hydrological conditions in the estuary have been affected by river and stream modifications as mentioned in section 5.3.1, which has altered the hydrology of the Lower Columbia River (ISAB 2000, Bottom et al. 2001, USACE 2001, Johnson et al. 2003b).

A series of islands and island complexes exist in the Lower Columbia River portion of the watershed, extending from Price Island to the west and Whites Island to the east. Most of the islands are undeveloped and contain quality wetland and riparian habitat. Many of the islands also contain and/or are in existence as a result of dredge spoil disposal (primarily from US Army Corps Columbia River Navigation Channel dredging). Puget and Little Islands are well populated and have notable agricultural and residential development. In fact, Puget Island is one of the fastest growing areas in the County (Draft Wahkiakum County Comprehensive Plan 2008). Much of these islands has been diked and converted to agriculture, primarily pastureland, utilized for dairy cattle in the past. However, residential and commercial development on the islands has increased particularly along Bernie and Welcome Sloughs. See Land Use map (Map 54) in APPENDIX E for land use data from 2010.

Land cover in this watershed is dominated by open water (~49 percent) followed by agriculture (24 percent) and forested land (15 percent). See Table 5.19 below and the Land Cover map (Map

43) in APPENDIX E. The eastern shoreline contains steep upland forested bluffs with pockets of tidal wetland areas. Below the bluffs is a gentle to moderately sloping and forested landscape containing SR 4. The terrain also contains several non-SMA creeks and streams flowing out to the Columbia River. Most of these uplands are coniferous upland forests with some scattered deciduous stands. Development is mostly sparse and is primarily along the SR 4 corridor and along the shoreline. There are scattered overwater structures, pile fields of varying densities and several areas designated as dredge mats. Descriptions of the Cathlamet Bay reaches can be found in APPENDIX A (Reach matrix).

Land cover in the Town of Cathlamet (Map 48 Appendix E) is mostly dominated by low to medium intensity development and developed open space, with a few areas of high intensity development and some small pockets of wetland, forest, and grassland habitat (see also Table 5.14 for context). The heavily-modified active waterfront is located along a central low terrace with sloping to steep landscape in the uplands, gaining elevation to the the north along Elochoman Slough, and to the east upstream of the Highway 409 Bridge to Puget Island.

West of the Town of Cathlamet, between the mouth of the Elochoman River and the mouth of Skamokawa Creek, the terrain changes from steep forested bluffs to developed and diked (agriculture) floodplains. These floodplains contain a variety of land cover types including intertidal wetlands, diked wetlands, and upland mixed and coniferous forest areas (See Land Cover map 43 in APPENDIX E). The fertile soil at the mouth of the Elochoman and relatively gradual slope of the floodplains has made the area important for both urban development and agricultural/rural development. Between the Elochoman and Skamokawa confluences is the Julia Butler Hansen National Wildlife Refuge (NWR) for Columbia white-tailed deer. According to data from the Lower Columbia Estuary Partnership (2012), the refuge contains primarily agricultural (pasture) land and diked herbaceous wetland. West of Skamokawa, the terrain returns to steep forested bluffs. There are stands of old growth forests on top of the bluffs starting just east of Jim Crow Creek (in the Wallacut River watershed) (~RM 28.5) to Skamokawa Park (RM 33).

Table 5.19 Cathlamet Watershed Land Cover

Land Cover Type	Acres	percent
Agriculture	3270.48	24.44
Aquatic Vegetation	0.00	0.00
Developed	17.78	0.13
Forest and Woodland	2022.93	15.12
Nonvascular & Sparse Vascular Rock Vegetation	0.00	0.00

Open Water	6536.73	48.85
Recently Disturbed or Modified	0.00	0.00
Shrubland & Grassland	1534.54	11.47
Total	**13382.46**	**100.00**

Source: NLCD 2012

Wetlands and Floodplains

Wetlands play an important role in the ecosystem processes that contribute to the Cathlamet Channel and the larger Columbia River Estuary.

Since 1948, tidal wetland habitats in the estuary have decreased by as much as 70 percent. Much of the remaining wetlands are protected by the National Wildlife Refuge System (the Julia Butler Hansen National Wildlife Refuges). In addition to the salmonid feeding, spawning, nursery, and migratory habitat they provide, these wetlands are critical to flood control and water quality (LCFRB 2010). The intertidal emergent habitat defined by Thomas (1983) may have been mapped as herbaceous wetlands by Johnson and O'Neil (2001) and IBIS (2003). In the Columbia Estuary, almost 31,000 acres of herbaceous wetlands have been lost and 140,000 acres in the Lower Columbia River province from 1850 to 1999 (Thomas 1983, Johnson and O'Neil 2001, and IBIS 2003).

In the Town of Cathlamet, wetland areas are located at the north end (freshwater forested/shrub) and just upstream of the Birnie Creek mouth (freshwater emergent and forested/shrub). Flood prone areas in town are located where there is low elevation at the marina breakwater, old sewer lagoons, Birnie Creek mouth and its ravine, and along Commercial Street just south of Broadway.

The area between Skamokawa Creek and the Town of Cathlamet is largely floodplain areas with in the Elochoman River watershed, despite having shoreline directly on the Cathlamet Channel of the Columbia River. These areas contain the majority of wetlands within the watershed, which consist of a variety of wetland habitat types. The Hunting Island complex is comprised of both freshwater emergent and forest/shrub wetlands. The NWI Wetland map 24 in APPENDIX E shows the approximate location of wetlands and 100-yr flood areas within the watershed. Table 5.20 summarizes the wetland and floodplain areas relative to the watershed in Wahkiakum County.

Much of the surrounding area in the lower floodplain areas in this watershed has been altered by the construction of a flood control levee, and by the excavation of a ditch network that transects the former wetland area (USACE 2012). This land has subsided behind levees and has resulted in unnatural uniformity and flatness of the topography. Additionally, there are scattered depressional wetted areas (USACE 2013). These areas, before being altered, had a dendritic network of tidal sloughs that weaved through the floodplain. Some wetlands are only connected to other water bodies through water control structures or other artificial mechanisms such as underground piping. A good example of this is the Julia Butler Hansen NWR, where several sloughs have been disconnected from the mainstem of the Columbia River and wetlands are connected to these sloughs by a network of underground pipes (USACE 2013).

Many of the sloughs and submerged wetlands that have limited connectivity to the mainstem of the Columbia may have water quality issues likely caused by an increase in stagnated water and a decrease in water exchange with the Columbia River (USACE 2012).

Vegetation on Price Island, adjacent to the Julia Butler Hansen National Wildlife Refuge and surrounding areas have been influenced by anthropogenic disturbances. The levee system largely prevents tidal waters or river flows from impacting floodplains within the watershed. The plant species that dominate the lower floodplain areas along the Columbia River include non-native pasture grass and the non-native variety of common rush (*Juncus effusus* var*. effusus*). This plant species is often present in wet pastures and is generally thought to reduce overall vegetative complexity.

Reed canary grass (*Phalaris arundinaceae*) and Japanese Knotweed *(Fallopia japonica),* classified as Class C noxious weeds by the Washington Noxious Weed Control Board, can be found throughout the disturbed floodplain areas. Due to the stagnant nature of the interior sloughs and constructed wetlands, Parrot feather milfoil (*Myriophyllum aquaticum*), another non-native noxious weed, is widespread within the Cathlamet Channel watershed. Common riparian plant communities within the watershed include beneficial native trees and shrubs such as red alder (*Alnus rubra*), elderberry (*Sambucus racemosa*), huckleberry (*Vaccinium parvifolium*), Sitka spruce (*Picea sitchensis*), red-osier dogwood (*Cornus sericea*) and willows (*Salix* sp.) (USACE 2013).

On Puget and Little Islands (northwest of Puget Island, across Birnie Slough)(See Maps 24 and 60), wetland types are dominated by diked, freshwater emergent wetlands. The downriver end of Little Island is separated by SR 409 and is dominated by Forested/shrub wetlands. The forest/shrub wetland type is also dominant on the islands upriver of Puget Island (Jackson and Whites Island) (See Maps 24 and 60 in APPENDIX E).

Table 5.20 Wetlands in Cathlamet Channel watershed

Associated Wetlands	Acres	percent Wetlands of total Watershed
Freshwater Emergent Wetland	3144.06	23.44
Freshwater Forested/Shrub Wetland	2097.45	15.63
Freshwater Pond	37.68	0.28
Floodplain	2426.16	18.08
Total Watershed Area	**13415.71**	

Source: NWI 2012, WBD BLM 2013

Aquifer recharge areas
The Critical Areas Map (Map 14) in APPENDIX E shows likely areas where aquifer recharge areas may occur. In this watershed, aquifer recharge areas occur on geological units that are known for having a high to moderate rate of permeability. Other important areas, such as wetlands, rivers and streams, and water and resource protection well information, are also used to identify potential recharge areas. The Columbia River, the 100-yr floodplain and Columbia River tributaries are likely areas for aquifer recharge. The majority of the water and resource protection wells occur along the shoreline and in immediate upland areas adjacent to Skamokawa Creek, the Elochoman River and their major tributaries. Puget and Little Islands have wells near Birnie Slough. The Town of Cathlamet (Map 15 Appendix E) shows a similar pattern for likely recharge areas along the Columbia and Elochoman Slough and the availability of municipal water minimizes reliance on wells.

Fish and Wildlife Habitat
Cathlamet Channel contains areas that are especially productive for benthic organisms, anadromous fish and waterfowl (LCFRB 2010). WDFW has identified a number of priority habitat areas for a number of species in the watershed (See the Priority Habitat Map 26 and 27 in APPENDIX E). The area is characterized by some of the most intact and productive intertidal emergent and forested wetland habitat remaining in the estuary largely located on the islands in Oregon and a few of the islands in Wahkiakum County; a large portion of Cathlamet Channel is protected by the Lewis and Clark National Wildlife Refuge in Oregon. The western edge of Cathlamet Channel contains part of the brackish oligohaline zone (area characterized by water with a salinity content of 0.5 to 5.0 parts per thousand due to ocean derived salinity), which is thought to be important during juvenile anadromous fish transition from fresh to salt water. Portions of Cathlamet Bay have lost substantial acreage of intertidal emergent/scrub-shrub wetland habitat as a result of dike construction(Thomas 1983 and LCFRB 2010).

The Town of Cathlamet has priority habitat for elk and geese. The Julia Butler Hansen (JBH) NWR (east of Skamokawa) is home to a variety of wildlife, including the threatened Columbia white-tailed deer (*Odocoileus virginianus leucurus*) and several species of waterfowl. A system of levees was originally constructed over the last century to convert the floodplain to pastureland. In 2013, the US Army Corps of Engineers, with the help of the US Fish and Wildlife Service, constructed 64 acres of restored tidally connected floodplain on the Julia Butler Hansen NWR to provide rearing and foraging habitat for juvenile salmonids. The project was expedited due to the eroding levee. In addition to the two levee breaches, a 2008 US Army Corps project on the refuge included the installation of three self-regulating tidegates to allow some fish passage and hydraulic connectivity.

There is a wide variety of native waterfowl and other bird species (both native and non-native) that are common throughout the watershed, particularly in the protected areas and undisturbed islands. Canada and cackling geese (*Branta canadensis, Branta hutchinsii)*, mallards (*Anas platyrhynchos*), wood ducks (*Aix sponsa*), teals (*Anas* sp.), and northern pintails (*Anas acuta*), utilize areas for nesting and foraging habitat. Shorebirds such as sandpipers (*Calidris* sp*.)* have also been observed in a number of areas along the Cathlamet Channel. Songbird species such as red-winged blackbirds (*Agelaius phoeniceus*), marsh wrens (*Cistothorus palustris)*, ruby- crowned kinglets (*Cistothorus palustris)*, and purple finches (*Haemorhous purpureus*) are also common in wetland and floodplain habitat in the watershed. Additionally, numerous species of raptors also inhabit the area, including owls, red-tailed hawks (*Buteo jamaicensis)*, harriers, falcons and bald eagles (*Haliaeetus leucocephalus)* (US Corps 2013). A representative list of bird species throughout the County, including on the Julia Butler Hansen NWR is in APPENDIX F.

The JBH Wildlife Refuge and surrounding area is known to have at least twelve different species of amphibians and reptiles; many of which inhabit the Steamboat Slough (USFWS 2004). Observed amphibian species include Pacific tree frogs (*Pseudacris regilla*), red-legged frogs (*Rana aurora*), rough-skinned newts (*Taricha granulosa*), and non-native bullfrogs (*Rana catesbeiana*). Reptiles recorded within the refuge include the northwestern garter snakes (*Thamnophis ordinoides*), common garter snake (*T. sirtalis*), northern alligator lizard (*Elgaria coerulea*), and painted turtle (*Chrysemys picta*) (USFWS 2004).

Puget Island has a comparatively large population of white-tailed deer and The Nature Conservancey's Robert W. Little Preserve at Grove Slough was established for their benefit. Additionally, many of the sloughs contain warm water fish such as largemouth bass (*Micropterus salmoides*) and species of sunfish (Centrarchidae) such as bluegill (*Lepomis macrochirus*)

Common fish species found in the Columbia River estuary as well as in the slough networks or in adjacent open waters include three-spine stickleback (*Gasterosteus aculeatus*), Pacific eulachon (*Thaleichthys pacificus*), Pacific herring (*Clupea pallasii*), surf smelt (*Hypomesus pretiosus*), and starry flounder (*Platichthys stellatus*). Several species of non-native fish known to utilize the aquatic habitat within the Steamboat Slough site include peamouth (*Mylocheilus caurinus)*, banded killifish (*Fundulus diaphanus)*, American shad (*Alosa sapidissima*) and common carp (*Cyprinus carpio)* (Johnson et al 2003b).

The mainstem of the Columbia River and adjacent tributaries and streams provide habitat for thirteen federally listed species units including eleven species of steelhead and salmon, green sturgeon, pacific eulachon, and bull trout.

<u>Frequently flooded areas</u>

The mainstem of the Columbia River within the Cathlamet Channel watershed exhibits dynamic ebb and flood characteristics. Historically, high flows from the spring freshets (May through June) frequently flooded lower elevation areas. As a result, off channel sloughs and wetlands were reconfigured (Wahkiakum County Flood Hazard Management Plan (WCFHMP) 2006). Construction of the hydroelectric dam system and irrigation withdrawals has altered the timing, intensity and volume of water flowing down the Columbia River (WCFHMP 2006) from historical patterns.

Tidal influences from the ocean also create flood characteristics along and within floodplain areas. Within the Cathlamet Channel, most of the islands are within the 100-yr flood hazard area. Puget Island and Little Island contain a system of levees that limit flood risk potential. Although some areas on both islands are prone to flood inundation (FEMA 1996, CREST 2006) (See Flood Hazard Map 17 in APPENDIX E). The large floodplains between Skamokawa and the Town of Cathlamet are also within the 100-yr flood hazard risk area and include an updated designated floodway near the mouth of the Elochoman River (See Maps 16 and 17 in APPENDIX E).

The Pacific International Engineering Report (PIER) (2002) identified several problems and potential solutions to water resource/flooding issues in the Cathlamet Channel watershed. Table 5.20 below summarizes those findings. The County Flood Hazard Management Plan (2006) identified several issues related to flooding as well as areas prone to overbank flooding. Figures 3.2-3.4 in Section 3.2.2 shows the approximate location of flooding-related issues. Figure 5.1 below shows some of the Puget Island locations with shoreline erosion issues noted in Table 5.21. Pile dikes and jetties along the mainstem of the Columbia River have contributed to erosion forces along the Puget Island shoreline (WCFHMP 2006).

Table 5.21 Summary findings of the PIER 2002 report

Location	**Problem**
County Sand Pit (Puget Island)	Deficit of dredge material
Brown Slough Pump Station (Puget Island)	Erosion
Grove Slough Tide Gate (Puget Island)	Sedimentation
North Welcome Slough Road (Puget Island)	Bank erosion
Ferry Terminal (Puget Island)	Deposition/Shoaling
Pancake Point (Puget Island)	Erosion
Cathlamet Channel	Sedimentation
Cathlamet Marina	Sedimentation

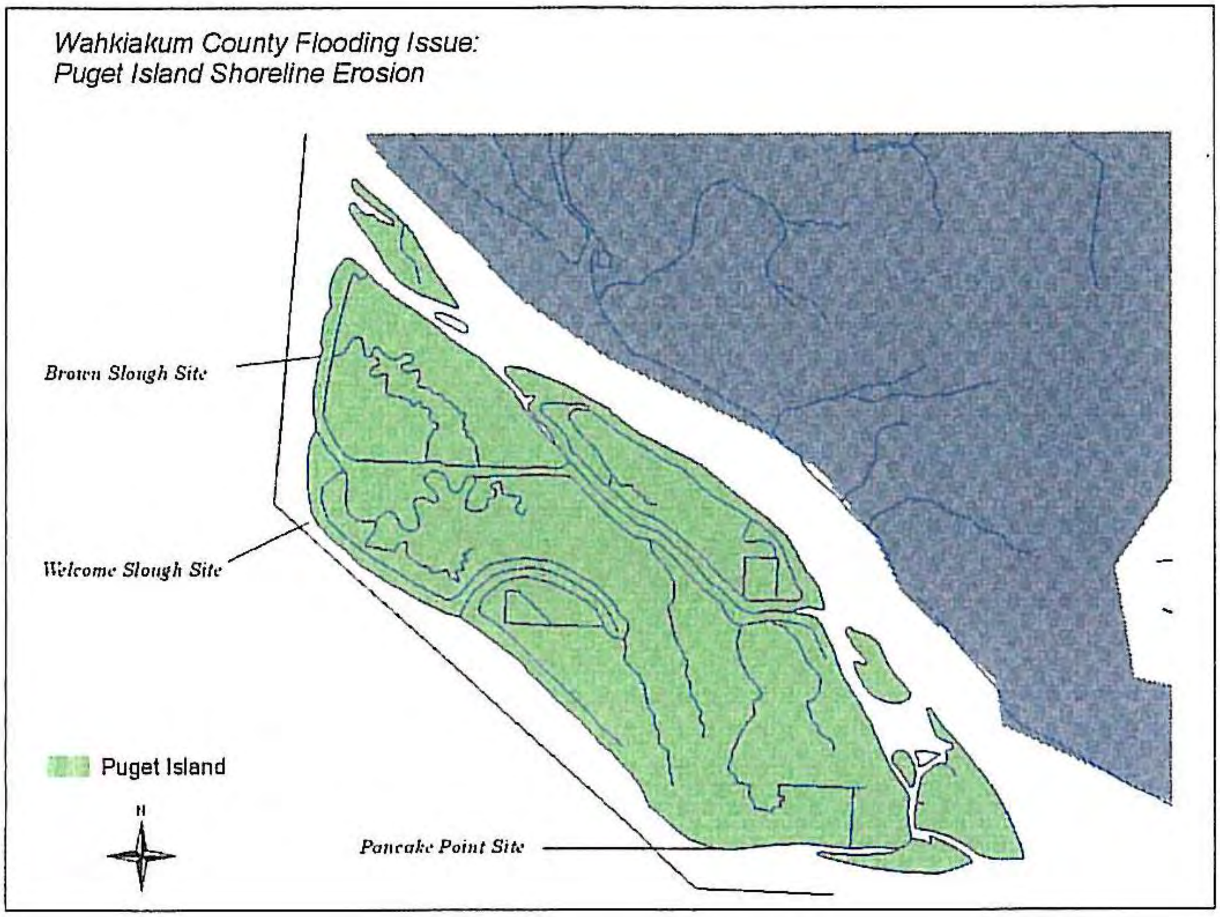


Figure 5.1 Areas of shoreline erosion (CREST 2002, WCFHMP 2006)

<u>*Geologically hazardous areas*</u>
The Cathlamet Channel – Columbia River watershed consists of a variety of landforms. Generally, the steep cliffs and bluffs along the river have a moderate to high landslide hazard risk and floodplain and areas with gentle gradients generally have a low risk of landslide hazards (See Landslide Hazard map in APPENDIX E Map 19). Moderate and high risk areas generally include the shoreline downriver of Skamokawa as well as the steep terrain upriver of the Town of Cathlamet. The Town of Cathlamet has areas with moderate landslide hazards on either side of Bernie Creek as well as areas alongside SR 409 north of the Columbia River (See Map 20 in APPENDIX E). According to the CREST (2006), Puget and Little Island are not considered to be in a landslide hazard risk area due to the islands' low-lying gradient and soil types. Ecological processes related to geology include geomorphic processes such as the interaction of water, sediment and creates channel and shoreline structure. This includes bank and bed erosion, channel migration and evolution, sedimentation, debris input, and accretion. Geologically hazardous areas, such as landslide areas contribute to natural sediment inputs that create habitat and carry nutrients downstream.

High risk of liquefaction hazards generally occur between Skamokawa and the Town of Cathlamet due to the high moisture capacity in the floodplain soils. Liquefaction is when ground and/or subsurface layers that are saturated with water, behave like a liquid when shaken by an earthquake, generally occurring in flatlands in floodplains and the Columbia River Estuary. Examples of liquefaction hazards include the ability for the ground to lose its ability to support structures and the loss of the ground down gentle slops on a liquefied layer,) The Town of Cathlamet has moderate to high liquefaction hazard risks adjacent to Hunting Island and along the shoreline south of the marina (CREST 2006, WDNR). Moderate liquefaction hazard risks occur in isolated areas upriver of the Town of Cathlamet to the County boundary. See APPENDIX E Maps 21 and 22 for liquefaction risk hazards throughout Wahkiakum County and the Town of Cathlamet. Liquefaction hazard risks cover the entire land area across both Little and Puget Islands as well as the island complex upriver of Puget Island.

5.5.2 Land Use and Shoreline Modifications

Much of the former tidal wetlands in this watershed is now owned by private landowners who actively manage it for agriculture (US Army Corps 2013 Steamboat Slough Environmental Assessment).

The majority of the growth in Wahkiakum County is occurring in Elochoman Valley and on Puget Island. The island was once characterized by dairy farms and pasture land. The trend on the island continues to be the subdivision of large, formerly agricultural parcels to single-family development. Development is particularly growing along the shoreline of the mainstem of the Columbia River and Bernie Slough. See Land Use Maps 52 and 53 in APPENDIX E for land use patterns in Wahkiakum County and the Town of Cathlamet.

This watershed has experienced significant shoreline modifications. This includes shoreline armoring, particularly on western side of Puget Island. Water control structures such as culverts, tidegates and levees are common in the watershed particularly on Puget Island and between the mainstem of the Columbia River and mainland Wahkiakum County and Town of Cathlamet where SR 4 nears the river. Other common modifications in the watershed include dredge material placement on the southern side of Puget Island, over water structures including docks in Bernie slough and in Welcome Slough on Puget Island, and pile fields along the islands and mainland adjacent to the Columbia River. These and other modifications are identified in the reach analysis and are found in the reach matrix in Appendix A as well as in the Shoreline Modification maps (49-51) in APPENDIX E. The shoreline within this watershed has been highly modified along the Columbia River and islands, particularly Little and Puget Islands with levees and shoreline armoring. Shoreline modifications include levees, pile dikes, culverts, bridges, armoring and tidegates. See Map 49 (Wahkiakum County), 50 (Town of Cathlamet) and 51 (Puget Island) in APPENDIX E.

The Town of Cathlamet has a zoning ordinance that designates areas for commercial, industrial and residential use as shown in Figure 5.2 below and Appendix E Map 52. The Town is reliant on the Elochoman River for its water source. Other home and business owners in the watershed get their water from wells or from the County PUD system. In fact, approximately two-thirds of the residential units in the basin rely on water from the Wahkiakum County PUD system (Economics and Engineering, Inc. 2002). The town does not require residences to connect to the Town's water system. Ultimately, the town's water supply and quality is subject to upriver impacts from activities such as logging, fish hatcheries and cattle operations along the shoreline and/or in the river (Economics and Engineering, Inc. 2002). Based on the SMP Visioning process, many community members expressed an interest in shoreline commercial and mixed-used water-oriented development. Trends in the Town suggest that an aging population will be the dominant demographic and adequate services and residential needs will be necessary to accommodate growth in an older demographic. This includes increased boating and water-related recreational opportunities and services that support these types of activities.

The Town of Cathlamet shoreline is heavily modified with bulkheads, a marina and armoring to protect the low, medium and high intensity development occurring on the shoreline. Levee development occurs along the northern portion of town protecting the log sorting yard from flooding. Starting at the marina, south to the Bernie Creek outlet, the shoreline is armored. There is commercial development at the Elochoman Marina that extends to just northwest of the SR 409 bridge, where medium intensity residential development occurs. Between the Bernie Creek outlet and SR 409 Bridge there are several derelict vessels and overwater development, which is largely being under-utilized for commercial or residential purposes. Lastly, there are several low and medium density pile fields from past development (not being utilized now) along the Town of Cathlamet shoreline. See Map 50 in Appendix E.

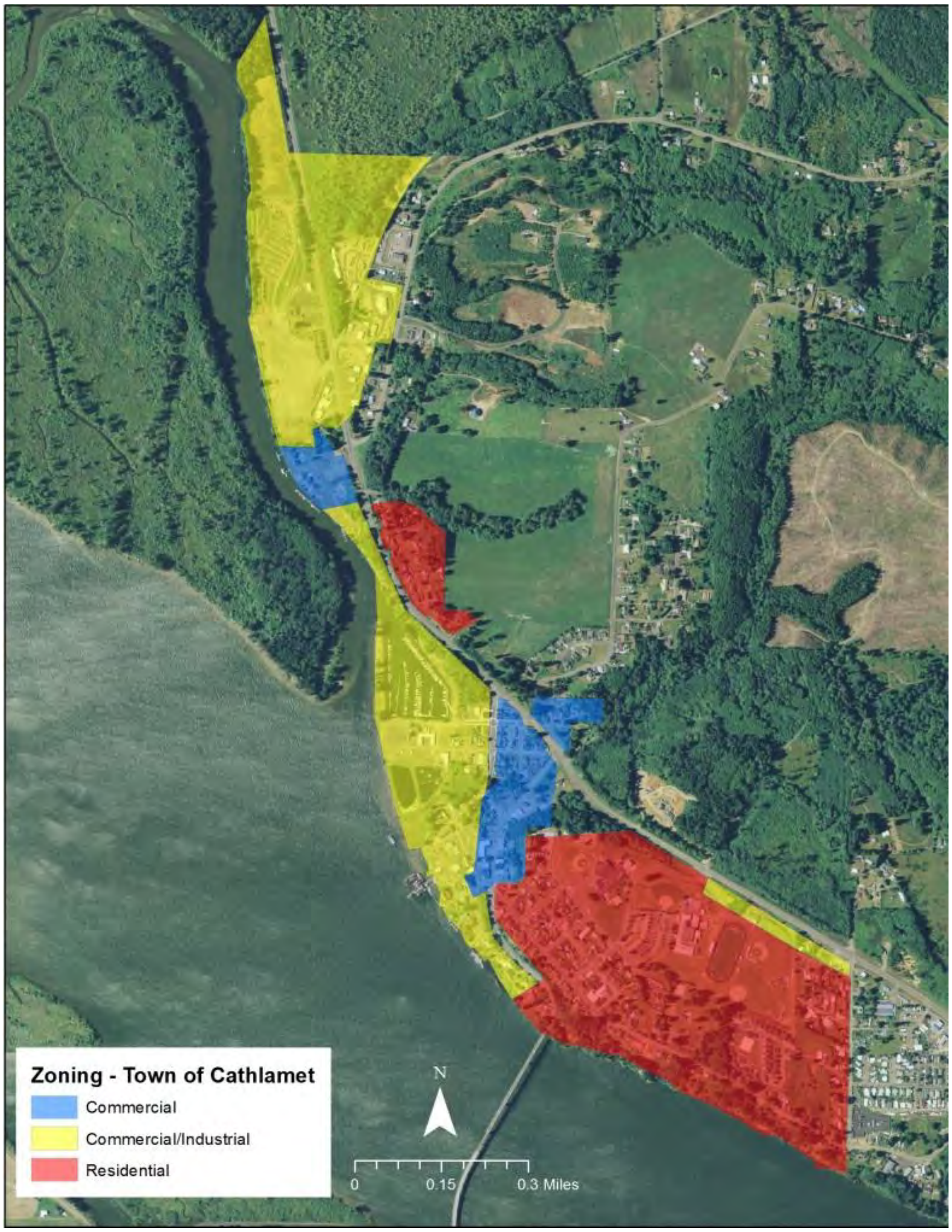


Figure 5.2 Town of Cathlamet Zoning (Town of Cathlamet)

Relatively speaking Puget Island is the fastest growing region in the County, although this rate of growth only includes approximately 20 shoreline permits (not including exemptions) over the last 25 years. Floodplains are slowly being converted from what was once being utilized for agriculture into single-family residential development on quarter to one acre properties. The trend is still relatively slow-growing in these areas as noted in the Draft Wahkiakum County Comprehensive Plan (2008). Table 5.22 below shows watershed-wide land uses from data provided by Ecology (2010) also shown in Appendix E Maps 52 through 54.

Table 5.22 Land use in Cathlamet Channel watershed

Land Use	Acres	Percent of Acres in Watershed
Agriculture	2,942.17	40.73
Cultural	0.00	0.00
Fishing Activities	0.43	0.01
Forestry	1.64	0.02
Government	17.26	0.24
Lodging	1.94	0.03
Non Commercial Forest	2.77	0.04
Open Space	2,187.87	30.29
Parks	0.55	0.01
Recreation	0.08	0.00
Residential (Misc.)	39.79	0.55
Residential (Multi-Family)	1,102.73	15.27
Residential (Single-Family)	503.67	6.97
Resource Production	0.02	0.00
Retail	11.94	0.17
Transportation	0.19	0.00
Undeveloped	409.43	5.67
Utilities	0.32	0.00
Total	**7,222.80**	**100.00**

Source: Ecology 2010

5.5.3 Public Access Opportunities

There are twelve public access opportunities that have been identified within the Cathlamet Channel watershed. Three are county road access areas on top of the levee separating the Columbia River from the USFWS' Julia Butler Hansen National Wildlife Refuge (NWR) for the Columbian white-tailed deer. Before a joint US Army Corps of Engineering-USFWS restoration project that breached a section of the levee in 2014, a county road followed the perimeter of the JBH NWR on top of the levee. The restoration project allows access from either entrance, but limits public access to one side of the breach or the other. This is an opportunity for fishing, bird watching and wildlife viewing.

Brooks Slough Boat Launch is located at Milepost 39 on SR 4, just east of 'downtown' Skamokawa. This 2.5 acres site hosts a small boat launch with limited parking and can be used to explore the Wildlife Refuge by water.

Strong Park is a two acre park located on the Town of Cathlamet waterfront adjacent to the Wahkiakum County Museum between the Elochoman Marina and Bernie Slough (See Appendix E Map 57). The park is connected to the Elochoman Slough Marina (RM 38) and Columbia River beach area by a boardwalk across the mouth of Birnie Creek and by waterfront trail. The full service marina and boat launch provide the public transient and permanent moorage, two launch ramps, and parking, picnic, restroom, camping facilities and more.

County Line Park, near the eastern/upriver County Boundary (RM 51.5), provides scenic views, RV and tent camping, beach access, fishing and kayak launching facilities

On Puget Island there are several public access opportunities. The Wahkiakum County Ferry, established in 1925, is available to pedestrian and vehicle traffic and takes passengers to and from the State of Oregon, across the Columbia River. The ferry terminal and small parking area provide scenic views of the Columbia River and surrounding landscape. There are also public opportunities to fishing and beach access on the Island. Public access opportunities are identified in the Public Access map (Maps 53) in APPENDIX E.

Additional public access points on Puget Island include

- East Tip Puget Island, which is identified as a primitive camping opportunity on the east side of the island.
- WDFW's Puget Island Water Access at Pancake Point provides parking, restrooms, bank fishing, beach access and scenic views.
- Beach access on a dredge disposal site on Whites Island is only accessible by boat (WDFW 2015).
- Svensen Park is a four acre park that provides the public access to a boat ramp, trailer parking, and other facilities. The park is located on Puget Island at West Sunny Sands Road, near its intersection with SR 409.
- Buffington Memorial Park, located at the end of SR 409 adjacent to the Wahkiakum Ferry Landing, is a small park that provides a pet exercise area, tables, public water access via a beach and a restroom. Further discussion of existing and potential public access opportunities are described in Section 6.1.3.
- Additionally, WDFW owns and manages The Whites Island unit, located at the eastern end of Puget Island, which contains 130 acres of floodplain habitat on White Island maintained as Columbia white-tailed deer habitat. The Whites Island unit property is specifically designated for wildlife habitat and does not currently have public access opportunities.

Additionally, there are several "informal" access locations along State Route 4 that have turnout areas along the Columbia River for viewer enjoyment. One of these locations is a popular wind surfing spot but due to a lack of signs and infrastructure, wind surfers often must cross the highway on foot at their own risk. The lack of signage and safety related infrastructure at these turnouts provides an important opportunity for improvement.

5.5.4 Restoration Potential and Considerations

So much of the Columbia River basin is dependent on the quantity and quality of the structure and function of the subbasins that flow into the Columbia River. Section 5.1.4 discusses how Important Areas and Impaired Areas were identified and compared (See Figure 5.5 and 5.6 in Section 5.4.4, which includes the Cathlamet Channel). The same methodology was utilized for the Cathlamet Channel watershed. The Cathlamet basin contains several locations that have both high ranked "Important Areas" and high to moderate level of impairment. The processes and impairments, the data used to represent them and the suitability analysis maps identifying these areas can be found

Section 5.4 along with the Elochoman River watershed. Much of the high ranking "Important Areas" are presented extensively along the river shoreline and to a smaller degree, along the non-SMA tributaries that flow into the Columbia River. Impaired areas of moderate to high ranking occur within the Town of Cathlamet and on Puget Island. SR 4, and some rural residential development east of the Town of Cathlamet, also generally pose a moderate impairment to ecosystem processes that overlap with high ranking Important Areas in and around Birnie Creek (a non-SMA stream) through the Town of Cathlamet, and where SR 4 and other impervious surfaces (i.e. development) are relatively close to the shoreline along the Columbia River. See Section 5.4 for maps. Reaches in the Town of Cathlamet are intensively developed. Much of the priority areas immediately adjacent to the Columbia River are rated for a combination of high restoration potential (south of the marina), conservation, and restoration/development. Further landward from the shoreline, much of the area is rated for development due to the fact that most of the area has already been developed; making stewardship approaches or the implementation of low impact land uses most appropriate. Areas such as the shorelines of Puget Island and the majority of the Town of Cathlamet generally have degraded and/or a higher impairement rating and therefore are recommended for focus/planned development, and in some locations, restoration work. See Map 64 and 65 for Puget Island and Town of Cathlamet restoration and preservation potential locations.

The best opportunities for restoration generally occur where impairments have occurred on areas considered to have important ecosystem functions/processes. Some examples include the PIER report (2002) and flood issues identified in Table 5.21. Other opportunities exist on public land such as on the Julia Butler Hansen National Wildlife Refuge and some state land on Puget Island. Several projects have already been completed by the County, Conservation District and by the Columbia Land Trust. These projects include tidegate replacement and streambank and habitat enhancement projects. A restoration project (completed in September 2014) and a tidegate replacement project (2008) was completed on the Julia Butler Hansen National Wildlife Refuge by the Army Corps of Engineers.

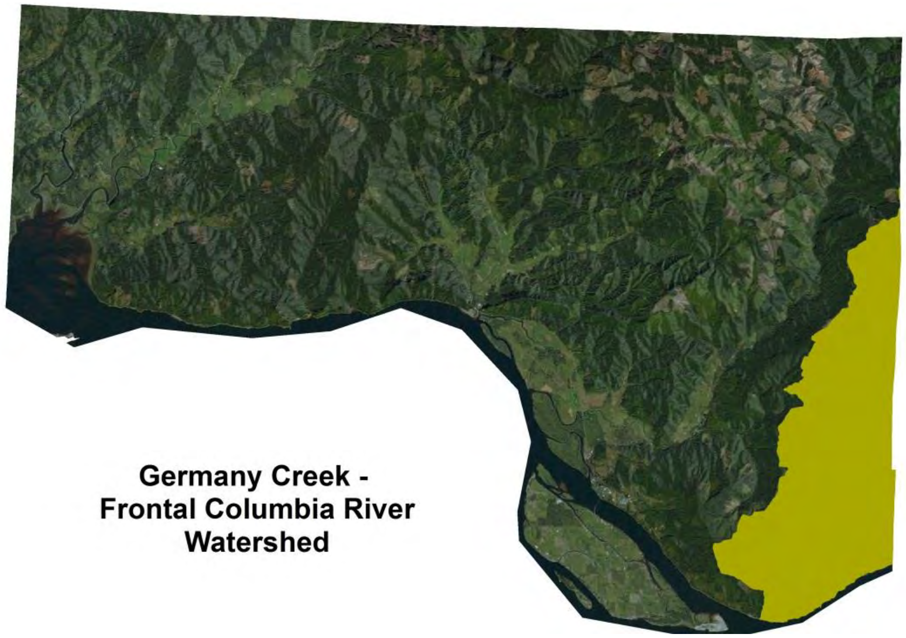
One of the major issues on the lower Columbia River is dredge material operations. Timing, quantities of removal, direct and indirect impacts of the operations and disposal play a role in both habitat quality and quantity. Dredging is important in maintaining the navigation channel and the continuation is important to local and global economies. There are many beneficial uses for dredged materials as identified by the Columbia River Estuary Dredged Material Management Plan (CREST 2002). For example, the use of dredged materials in the lower Columbia River is a potential opportunity to create intertidal habitat that has been in decline since the late 1800's (Thomas 1983) and is important to salmonids and other species of fish and wildlife.

The Lower Columbia River & Subbasin Plan (LCFRB 2010) identifies several measures to protect the structure and function of the Columbia River, which will likely help restore/protect salmonids throughout the Lower Columbia Basin. These measures listed below can be a guideline for identifying species restoration and protection focus areas.

- Restore tidal swamp and marsh habitat in the estuary and tidal freshwater portion of the lower Columbia River.
- Protect and restore riparian condition and function.
- Improve understanding of interrelationships among fish, wildlife, and limiting habitat conditions in the estuary and lower mainstem.

- Limit the effects of toxic contaminants on salmonid and wildlife fitness and survival in the Columbia River estuary, lower mainstem, and near shore ocean.
- Mitigate channel dredge activities in the Columbia River estuary and lower mainstem that reduce salmon population resilience and inhibit recovery.
- Restore connectedness between river and floodplain.
- Restore or mitigate for impaired sediment delivery processes and conditions affecting the Columbia River estuary and lower mainstem.

5.6 Germany Creek – Frontal Columbia River



5.6.1 Physical and Biological Characterization

The majority of the Germany Creek watershed is in Cowlitz County. However, a portion of Mill Creek (GFC_MillCreek_01) and the South Fork of Mill Creek (GFC_SouthForkMill_01) and some smaller non-SMA streams are in Wahkiakum County. All floodplain, riparian, and upland SMA jurisdictional areas immediately adjacent to the Columbia River within the Wahkiakum County portion of the Germany Creek Watershed are summarized and described in the Cathlamet Channel watershed section (Section 5.5) since the resources, land use, and any impairments directly affect the Columbia River (Cathlamet Channel watershed). Map 6 in the Mapfolio generally shows the distinction between the watersheds, but Map 1 (Shoreline Jurisdiction) and Map 58 (Reaches) illustrates the relationship between the Columbia River and the adjacent SMA jurisdiction and reaches within the jurisdiction.

The Germany Creek watershed within Wahkiakum County consists of approximately 18,465.91 acres. SMP jurisdiction covers approximately 304.69 acres of shoreline, which mostly includes relatively dense coniferous and deciduous land cover in the riparian and floodplain valleys of the SMA streams. Much of the surrounding uplands has been logged throughout the last century. Mill Creek empties into the Columbia at River Mile 53.5 in Cowlitz County, west of the mouth of Germany Creek. Most of Mill and Germany Creeks in Wahkiakum County are enclosed by relatively steep slopes and contain small to non-existent floodplains. Much of the area is tracked with logging roads within commercially logged private and state-owned land.

Stream flow in the upper reaches of Mill Creek can be flashy. Consequently, there is the potential for a lot of sediment moving down the watershed during freshet episodes. These erosion forces can be exacerbated by the logging practices that occur in the upper watershed. However, according to Pacific Water Resource, Inc. (2004), the lower Mill Creek is in fairly stable geomorphic condition in both Wahkiakum County and portions of Cowlitz County. Although, some relatively minor local erosion is known to occur throughout the basin..

The relatively small percentage of impervious surface in these basins has little impact on flow rates. Imperviousness here is mostly from roads and was estimated at around 2 - 2.8 percent (Pacific Water Resources, Inc. 2004) of the total surface area in the entire watershed (Wahkiakum and Cowlitz Counties).

Mill Creek and its tributaries have a high percentage of the land area that is forested. The Germany Creek watershed in Wahkiakum County contains approximately 64 percent of forested and woodland land cover (Table 5.23 and Land Cover map (Map 43) in APPENDIX E). Recently disturbed or modified land area in this region is attributed to logging operations. Land throughout the watershed is largely managed by both the WA Department of Natural Resources and private timber companies for timber production (Pacific Water Resources, Inc. 2004, Protected Area Database (PAD) 2012). See Public Access Map (Map 53) in APPENDIX E that also shows state-owned lands.

Table 5.23 Land cover types in Germany Creek watershed

Land Cover Type	Acres	percent
Agriculture	33.12	0.18
Aquatic Vegetation	0.00	0.00
Developed	33.35	0.18
Forest and Woodland	11857.70	64.23
Nonvascular & Sparse Vascular Rock Vegetation	0.00	0.00
Open Water	67.80	0.37
Recently Disturbed or Modified	6456.26	34.97
Shrubland & Grassland	13.56	0.07
Total	**18461.79**	**100.00**

Source: NLCD 2012

Wetlands and Floodplains

Wetlands play an important role in the ecosystem processes that contribute to the Germany Creek Watershed and the Cathlamet Channel of the Columbia River.

The relatively steep terrain and narrow creek bottoms/floodplains limit the presence of wetlands in this section of the watershed. Isolated depressional forested, shrub, and emergent wetlands exist in the watershed and along the Mill Creek jurisdictional shoreline. Table 5.24 below summarizes the wetland classifications and acreages identified in the Germany Creek watershed in Wahkiakum County. In Wahkiakum County, most of the forested and shrub wetlands along the shoreline of Mill Creek are in the lower reach. An isolated area of emergent wetlands is found in the upper reach of Mill Creek (See NWI Wetlands Maps 24 and 25 in APPENDIX E).

Roads adjacent to Mill Creek have confined the stream channel throughout this subbasin. Side channels are rare within the subbasin. Wahkiakum Conservation District stream surveys noted that most side channels were typically short, associated with accumulation of bedload, and appear highly transient in nature (Wade 2002) offering minimal habitat value.

Table 5.24 Wetlands in Germany Creek watershed

Associated Wetlands	Acres	Percent Wetlands of Total Watershed
Freshwater Emergent Wetland	23.12	0.13
Freshwater Forested/Shrub Wetland	63.93	0.35
Floodplain	90.39	0.49
Total Watershed Area in the County	**18456.91**	

Source: NWI 2012, WBD BLM 2013

Aquifer recharge areas
The Critical Areas Map (Maps 14) in APPENDIX E shows likely aquifer recharge areas in the Wahkiakum County portion of the Germany Creek watershed. Aquifer recharge areas often occur on geological units that are known for having a high to moderate rate of permeability. These geological formations combined with areas containing wetlands, streams, other surface water sources and resource protection wells are also used to identify potential recharge areas. The majority of the water and resource protection wells occur along tributaries and near wetland areas, but not directly along Mill Creek as there is little development other than logging roads in this area.

Fish and Wildlife Habitat
Winter Steelhead, coho, and fall chinook are all known to spawn in both the South Fork and mainstem of Mill Creek, including its upper reaches. See Maps 40, 34 and 30 in APPENDIX E. WDFW has identified priority habitat areas for a number of species in the watershed. Species include coho, rainbow trout, winter steelhead, fall Chinook, marbled murrelet, Roosevelt elk, and northern spotted owl. PHS habitats include palustrine (inland wetland) aquatic habitat. See PHS map (Map 26) in APPENDIX E.

Frequently flooded areas
The Wahkiakum County area of the Germany Creek watershed contains the upper reaches of Mill Creek and the South Fork of Mill Creek. The floodplains are narrow and enclosed by relatively steep upland slopes. As a result, no flood hazard risks have been identified in the Wahkiakum County portion of the watershed. See Shoreline Jurisdiction map (Map 1) and Flood Risk Map 17 in APPENDIX E.

Geologically hazardous areas
Germany Creek watershed has similar soil characteristics to the Grays Bay watershed. The bedrock is within 10 feet of the surface. Exposed rock would be mostly confined to steeper slopes and stream channels. Soils on top of the bed rock in high risk areas are considered "unstable" and pose an increased risk to landslide hazards (Pacific Water Resources, Inc. 2004).

The moderately steep gradients and soil types along Mill Creek present a moderate landslide hazard risk along the shoreline. The South Fork of Mill Creek has isolated areas of landslide hazard risk. See the Soil Series map (Map 7) in APPENDIX E for a map of soil types common in the watershed and the Landslide Hazard map (Maps 19) in APPENDIX E for a map of landslide hazard areas.

Slopes in the watershed are generally greater than 15 percent (Pacific Water Resources, Inc. 2004). Steep slopes and soil types in this watershed are consistent with areas of increased landslide hazards although slopes within the riparian areas and floodplains are more gradual (zero (0) percent to five (5) percent).

Ground-shaking or liquefaction potential was not detected in the watershed according to WDNR GIS data (See Liquefaction Hazard map (Maps 21) in APPENDIX E). The relatively steep gradients (little or no floodplain) reduce the liquefaction hazard risks on both Mill Creek and the South Fork of Mill Creek.

Additionally, the high use of the watershed for logging and road-building by the timber industry may result in erosion issues downstream during higher peak flows. Highly erodible soils combined with ground disturbing activities in these areas can result in slope failures along the shorelines. (WCFHMP 2006).

5.6.2 Land Use and Shoreline Modifications

The Mill Creek basin is almost entirely forest land, with scattered rural residential development along the lower mainstem and lower South Fork Mill Creek.

As mentioned in Section 5.6.1, land cover is largely coniferous/mixed forest types. Much of the watershed is utilized for forestry, the predominant use (~ 97%). As a result there is little of other use & development in the watershed with the exception of some rural residential development (~1.7%) and small agricultural operations (<1%). Aerial photo analysis shows consistent continuous logging over the years. Table 5.25 summarizes land use in the Wahkiakum County portion of the Germany Creek watershed.

Forestry practices, under the Washington Forest Practices Act, require some level of riparian protection. Little shoreline modification has occurred in the Wahkiakum County portion of the watershed partially because there isn't a lot of development. Additionally, logging operations have legal requirements to leave some riparian areas intact. Because of the roads required for logging activities, some stream crossings do occur throughout the watershed with culverts being prevalent in the upper watershed, which are both a fish access barrier and change the hydraulics of the stream, particularly if culverts fail.

Table 5.25 Land use in Germany Creek watershed

Land Use	Acres	Percent in Germany Creek Watershed
Agriculture	14.36	0.08
Forestry	17,790.53	96.60
Non Commercial Forest	31.58	0.17

Open Space	80.15	0.44
Parks	5.33	0.03
Residential (Misc.)	12.20	0.07
Residential (Multi-Family)	16.99	0.09
Residential (Single-Family)	274.27	1.49
Undeveloped	133.34	0.72
Utilities	58.46	0.32
Total	**18,417.21**	**100.00**

Source: Ecology 2010

5.6.3 Public Access Opportunities

Much of the land surrounding SMA streams in the Wahkiakum County portion of the Germany Creek watershed suggests limited public access opportunities because the South Fork of Mill Creek is primarily surrounded by private property. The mainstem of Mill Creek in Wahkiakum County is surrounded by state owned forestry land managed by DNR. Due to the lack of road access to Mill Creek, public access is limited along the shoreline. Further discussion of existing and potential public access opportunities are described in Section 6.1.3. Existing public access areas can be viewed in APPENDIX E (Map 52)

5.6.4 Restoration Potential and Considerations

Section 5.1.4 discusses how Important Areas and Impaired Areas were identified and compared throughout the County. The same methodology was utilized for the Germany Creek watershed. Results show that much of the watershed is prioritized for conservation with some areas identified as best for development and/or restoration Impaired areas generally coincide with impervious surfaces (road construction throughout the watershed and some residential development in the southeast portion of the watershed in Wahkiakum County) (See Figure 5.7 below). SR 4 coincides with the majority of the moderate to highly impaired areas in the watershed. As a result, some important areas for ecosystem processes, such as wetlands, and non-SMA tributaries are also along SR 4 and are considered potential restoration sites according to Figure 5.8 below and the Ecosystem Analysis approach described in Appendix D. The potential for restoration in this watershed, particularly in areas that, according to the analysis, occur on the shorelines of the Columbia River is minimal due to the infrastructure associated with SR 4 and the lack of major tributaries in this area. However, further investigation should be done to determine if culvert replacement and other such restoration projects are or aren't needed in the watershed. Additionally, the large portion of publicly managed land in the watershed that is logged under the Washington Forest Practices Act provides important protections in the upper watershed that play an important role in maintaining the ecosystem processes in the watershed. This may include riparian vegetation buffers to prevent sediment inputs from entering the system, maintain water quality and habitat structures. See APPENDIX D for the table of ecosystem processes and description of the Impaired and Important Areas.

The reach matrix in APPENDIX A also suggests potential restoration opportunities on a reach by reach basis. Table 5.27 below describes General Recommendations based on the ecosystem-wide analysis and suggests potential management options for each recommendation. The reach matrix in

APPENDIX A also identifies potential management recommendations by reach. Additionally, Wade (2002) identified priority habitat considerations for the watershed that includes:

- From RM 10 to RM 12 Mill Creek flows through a series of wetlands with quality side channel habitat and connected floodplains.
- Identify and protect limited chum spawning sites in the subbasin.
- Preserve and enhance floodplain connectivity in lower Germany Creek (not in Wahkiakum County)

Logging roads on private and state-owned forestry land that is heavily logged within the watershed present an opportunity for restoration that would benefit shoreline ecological functions. These practices, particularly clearcutting and road building, may impair ecosystem functions and impact stream quality. Efforts to protect important in-stream and riparian habitat, as well as water quality could be enhanced by working timber companies and DNR where appropriate, to fix culverts, deactivate unused/abandoned logging roads, and upgrade logging roads to prevent erosion, runoff, and ill-constructed stream crossings. Timber extraction should continue to follow state forestry act provisions to protect riparian buffers that ensure riparian habitat protection and minimize excess sediments and nutrients entering the waterway.

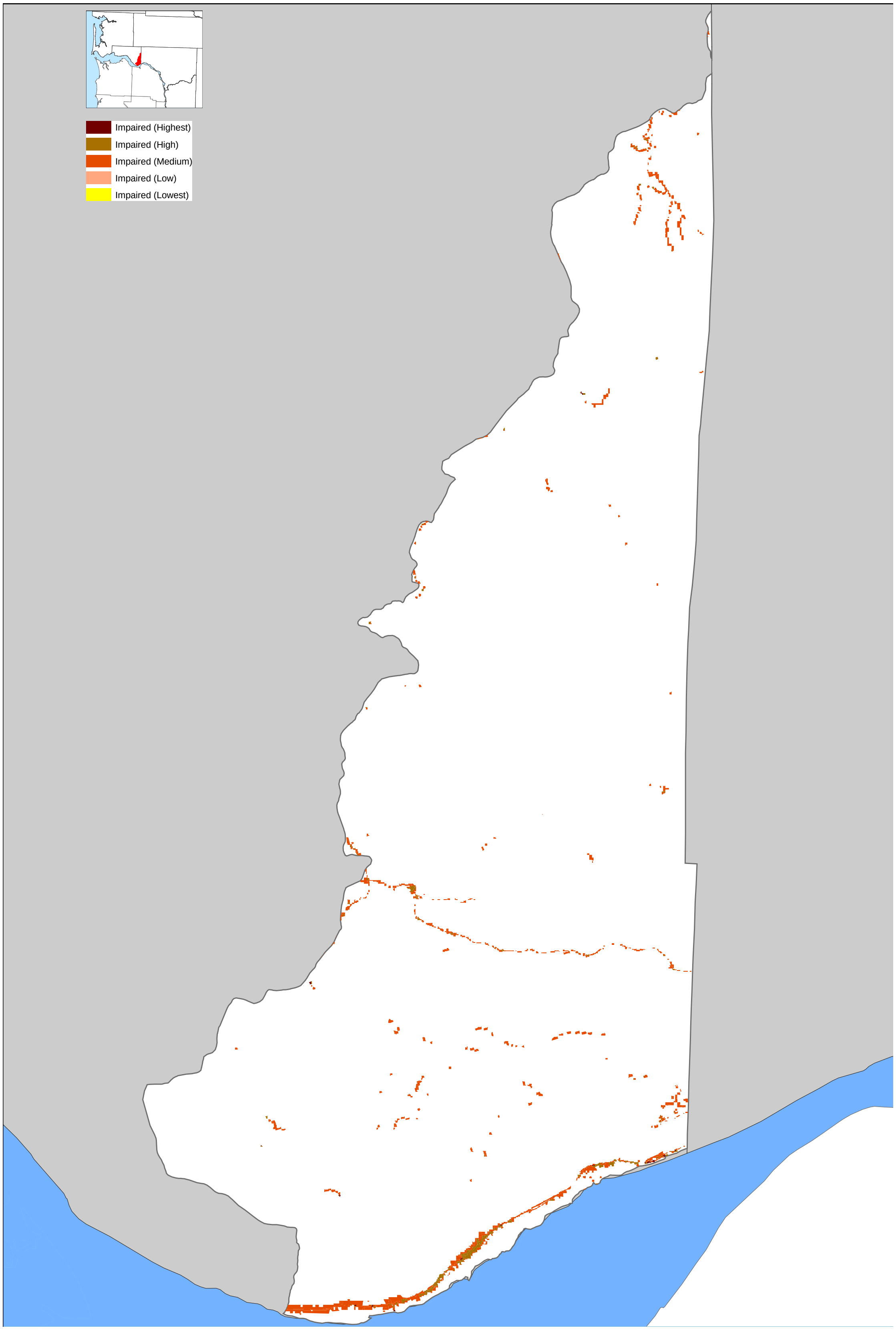

Impaired (Highest)
Impaired (High)
Impaired (Medium)
Impaired (Low)
Impaired (Lowest)

Figure 5.7 Germany Creek Ecosystem Analysis (Impaired Areas)

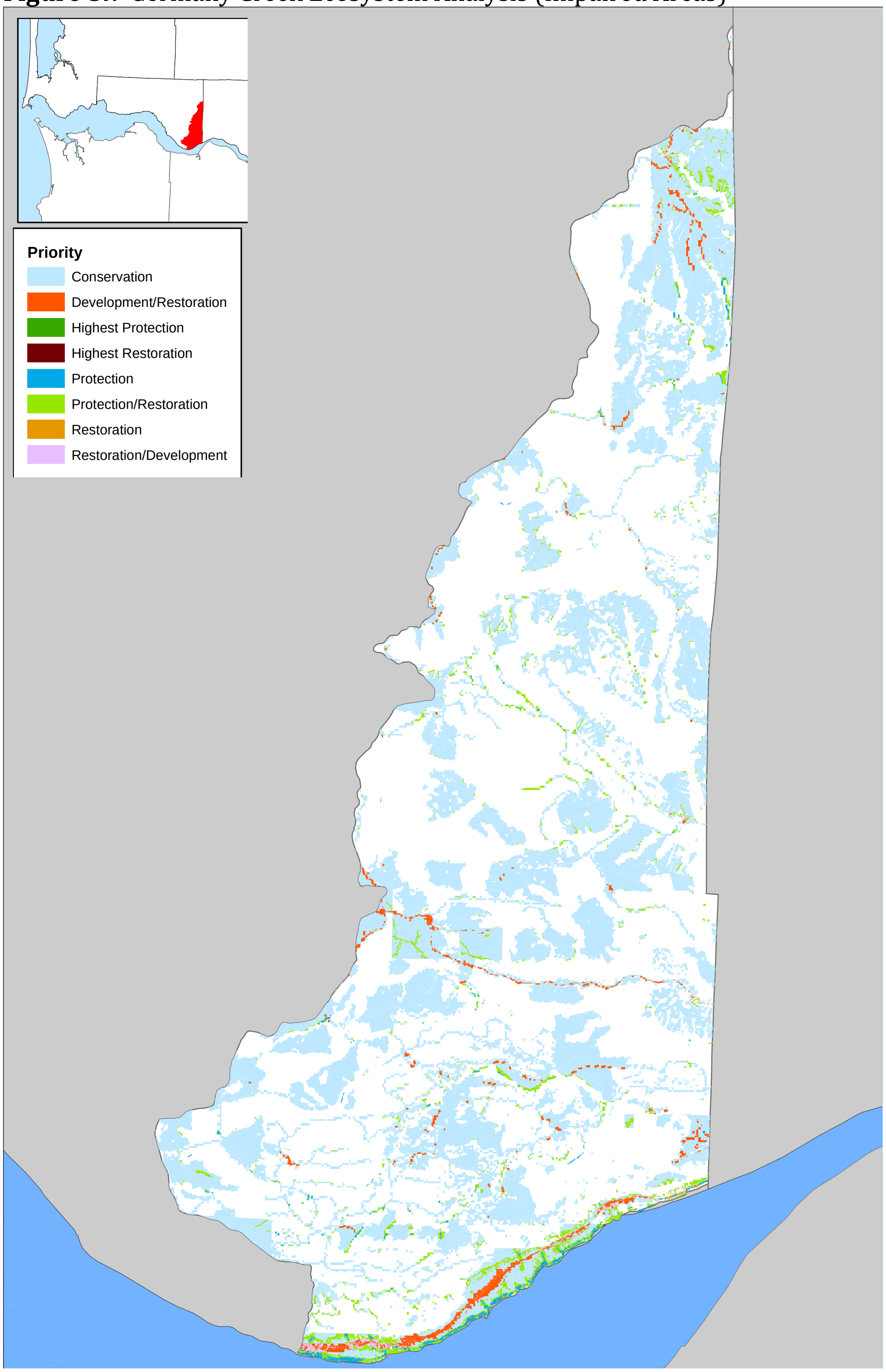


Figure 5.8 Germany Creek Watershed Ecosystem Analysis (Priority Areas)

5.7 WRIA 25 Key Management Issues and Opportunities

Wahkiakum County is largely utilized for agriculture and forestry. The County also has not seen a lot of growth over the last 20 years, which has preserved/protected many ecological functions along the shoreline. While there are many areas containing high value ecosystem functions that are still intact, historic land uses requiring the establishment of water control structures such as levees, historic logging practices, etc. negatively impact the shoreline ecosystem functions.

WRIA 25 has several key management issues in and around SMA shorelines. These issues are listed and discussed in more detail below.

- Overwater structure frequency, size, use, and continued development on Puget and Little Island.
- Urban development in the Town of Cathlamet, on Puget and Little Islands, and in the rural population centers of Grays River, Deep River, and Rosburg.
- Forestry issues resulting in increased sedimentation and erosion forces in the subbasins, particularly in Grays River.
- Runoff resulting from a large number of logging roads has resulted in a loss of riparian habitat and increases instream temperatures.
- Placement of culverts and tidegates that can result in stream blockages (log and debris plugs) and prevent fish passage.
- Gravel build-up near the well field in the Grays River Basin ((Economics and Engineering, Inc. 2002).
- US Army Corps dredge disposal near the mouth of the Grays River which has slowed flows (Economics and Engineering, Inc. 2002).
- System of drainage ditches and dikes have degraded floodplain connection/conditions in most of the lower floodplain areas in WRIA 25 (See Shoreline Modifications map (Map 49 in APPENDIX E).
- Many places with low levels of LWD and low likelihood of recruitment (see Limiting Factors map (Map 63) in APPENDIX E).
- Large number of landslide areas, particularly in the upper Grays River area.
- Riparian conditions and riparian road construction.
- Dredging in the mainstem of the Columbia River and disposal of the spoils.

Riparian Condition

Proper forest management is critical to riparian and in-stream habitat protection and recovery. Several reports/analyses suggest that riparian conditions do not meet quality habitat standards throughout most of the basin (Wade 2002, Economic and Engineering Services 2002, LCFRB 2010 and CREST 2006). See Limiting Factors Analysis map (Map 63) in APPENDIX E. The East Fork Grays and smaller tributaries have been identified as exceptions to the substandard rating. Past forest practices have reduced riparian habitat quality subsequently affecting water quality, altering stream flow, and increasing sediment inputs (LCFRB 2010). These effects have been amplified due to typical high annual rainfall and erodible soils (LCFRB 2010).

Sedimentation, Bank Erosion, Bank Stability

The Grays River flows through areas with extremely unstable soils and geology. This natural instability, combined with widespread road construction and timber management throughout the upper areas of WRIA 25, has led to substantial sediment loads and unstable, aggrading stream channels. According to Wade (2002), the extent of impacts to fish production from spawning substrate instability is unknown, but often considered the major limiting factor for chum and Chinook salmon production in the watershed.

Bank erosion problems have been identified in areas with alluvial deposits and with little or no woody vegetation. Bank erosion is widespread throughout the agriculture areas in the Skamokawa Creek watershed. A combination of conditions affect stability in these areas including alluvial soils, an entrenched stream channel, lack of riparian vegetation, and upper watershed conditions that may have increased peak flows. Bank stability problems occur in the West Fork Elochoman and North Fork Elochoman due to mass wasting. (Wade 2002).

There is a limited ability to influence forest practices within the WRIA. For the most part, local regulations are not allowed to conflict with the Forest Practices Act, which regulates private and state forest lands. This limitation also includes watershed plans as described in RCW 90.82.120. Additionally local jurisdictions do not have the authority to regulate federal and or state lands. Exceptions to this include practices such as building roads, trails, bridges and replacing culverts are considered development under the SMA. These practices are regulated under local Shoreline Master Programs as well as the Forest Practices Act (RCW 76.09). The SMA does not exempt these forest practices from the requirement for a Substantial Development Permit (SDP). SMP Guidelines state that master programs should primarily rely on the Forest Practices Act to manage commercial forests (Ecology).

Large Woody Debris/Pool Habitat
Stream surveys have found that the pieces of LWD/mile and the percentage of pool habitat fall well below habitat standards in most of the watersheds throughout the WRIA. Channels have frequently been simplified through channelization, diking, splash damming, and the removal of LWD (Wade 2002). The frequency of pool habitat is affected by the presence of and opportunity for LWD to enter the system. The poor rating in the limiting factors analysis coincides with the areas rated poorly for pool habitat frequency (See the limiting factors analysis map (Map 63) in APPENDIX E) (Wade 2002 and CREST 2006).

Floodplain Connectivity
Most of the streams within the basin have been disconnected from their floodplains. Additionally, the natural development of side channel habitats has been discouraged by management practices particularly in the lower reaches of the watersheds. Past and current practices include flood control measures, bank hardening, and channelization to improve agriculture and splash damming. Surveys conducted by the Conservation District indicate that the available side channel habitat is limited and highly transient in nature (Wade 2002).

Roads adjacent to the stream have confined the stream channel throughout this subbasin. Side channels are rare within the subbasin. Wahkiakum Conservation District stream surveys noted that most side channels were typically short, associated with accumulation of bedload, and appear highly transient in nature (Wade 2002) offering minimal habitat value.

Water Quality

Clean, cool, and clear water is essential to salmonids. The health of aquatic habitats declines as temperature, turbidity, nutrients, and other impacts exceed natural ranges and if chemical and biological contaminants are found in significant quantities (LCFRB 2010). These impacts are exacerbated by the effects of agriculture, development, channel modification and forestry practices. Fall freshets generally cool stream temperatures to within recommended stream guidelines for fall spawning salmonids, but elevated stream temperatures caused by forestry, development, and agricultural practices may negatively impact juvenile salmonids, resident fish, and migrating fish in the early fall (Wade 2002). See Water Quality map (Map 23) in APPENDIX E. Turbidity was identified as a concern in several tributaries to SMA waterways including Hendrickson Creek (Deep River), "Muddy Trib" (tributary to Grays River), West Fork Grays River and South Fork Grays River. Turbidity is often elevated due to mass wasting and bank instability. Additionally, aluminum toxicity due to has been identified as a concern in the Mill Creek (Wade 2002).

Fish Access and Water Quantity

Low flows and/or peak flows were identified as a concern in Deep River, Seal Slough likely due to the accumulation of bedload, the lower West Fork Grays River, a section of the main stem Grays River between the Covered Bridge and the Canyon, and the Elochoman River from the Beaver Creek hatchery upstream to the West Fork Elochoman River. Low flow concerns may be associated with the accumulation of bedload in the West Fork and main stem Grays River and inhibit salmonid access to spawning habitat (Wade 2002). Hydrologic immaturity and high road densities potentially increase peak flows in the most watersheds. Low flows likely limit the available rearing habitat during summer months (Wade 2002). It is known that Chum, fall Chinook, and coho salmon utilize the lower valley reaches of the Elochoman River and Skamokawa Creek and are heavily impacted by agricultural practices. High road densities and hydrologic maturity contribute to elevated peak flows in all areas of the Subbasin.

Road crossings (i.e. culverts and bridges) throughout WRIA 25 are frequent in the upper watersheds where logging operations are a dominant land use. These structures not only provide a pathway for water, sediment and organic debris to flow downstream, but they also provide a route for fish passage upstream and/or downstream throughout the different basins. Culverts not designed, installed, and maintained properly, can become fish passage barriers. Tetra Tech Inc., et al. (2009) has stated that fish barriers in the mainstem of the Grays River are generally not a concern. However, forest road culverts have blocked fish passage in small tributary streams (LCFRB 2010). These forest practices in the upper watershed impact species such as winter steelhead and coho that are known to occupy upper watershed reaches (LCFRB 2010).

Forest management in the Elochoman watershed is the only listed management technique considered to have a high potential impact upon flows primarily by increasing both peak flows and flows during the low flow season, because a majority of land in the watershed is forest. Due to the predominantly forested land cover of the upper and middle portions of the Elochoman River subbasin, forestry practices have likely influenced in-stream conditions throughout the history of the timber industry. For a heavily forested area like the Elochoman River subbasin, these effects are significant (LCFRB 2003).

Land use conflicts

While development has been relatively slow in Wahkiakum County compared to other counties in Washington, areas with the most development and land use change are located on Puget Island and in the Elochoman River valley. The change in land use from large agricultural and/or open space, to more intensive land uses (residential and commercial development) places a greater burden on water and shoreline resources and ecosystem functions. Areas identified as important both in the ecosystem-wide process analysis and in reports that have evaluated some of the watersheds in WRIA 25 are analyzed in this report. Land use conflicts in Wahkiakum County are largely not an issue as the County is experiencing slow population growth and much of the land use has remained unchanged. However, specific areas, such as the rural center in Skamokawa, Puget Island, and Elochoman Valley have seen some conversion of land use from agricultural to residential development. This development is a concern for potential land use conflicts as agriculture is an important economic driver in the county. Additionally, the navigation channel maintenance by the Army Corps of Engineers combined with upriver historic forest practices has resulted in issues such as accretion of the lower Grays River and Grays Bay (Columbia River), which has limited recreational and commercial boat access on Grays River. Forest practices in the upper watershed are still affecting watershed ecosystem processes, despite improved forestry practices that have affected fish access, erosion and accretion rates downstream. Additionally the construction of levees and other water control structures continues to disconnect floodplains streams and rivers, particularly in the lower reaches of the waterways. This has had profound effect on hydraulics, habitat structure, food web connections and other ecosystem functions. The land use analysis described in Chapter 6 further describes population and land use trends and conflicts in the County and Town.

Columbia River Mainstem
The Lower Columbia Salmon Recovery & Subbasin Plan (LCFRB 2010) identifies and describes a variety of limiting factors in the mainstem of the Columbia River and its tributaries. The discussion below is a summary of limiting factors and management issues described in the plan.

Changes caused by human activities have substantially influenced current habitat conditions in the lower Columbia River mainstem and estuary. Changes in river flow, circulation, water quality, contaminants, channel alterations, and predation may all be having impacts on salmonids. The estuary provides a critical opportunity for juvenile salmonids to achieve the growth necessary to survive in the ocean. The proximity of high-energy areas with ample food availability and sufficient refuge habitat are a key habitat features necessary for salmonid growth and survival in the estuary. Loss of connections among these habitats can determine whether juvenile salmonids are able to access the full spectrum of habitats they require. Potential restoration and replacement/enhancement targets have been developed by several entities including the Wahkiakum Conservation District, Columbia Land Trust, US Army Corps of Engineers (Steamboat Slough and NWR tidegate replacements), US Fish and Wildlife Service (Steamboat Slough and NWR tidegate replacements), Wahkiakum County Public Works, Lower Columbia Fish Recovery Board and Tetra Tech et al. (2009). Many of these existing and planned projects can be viewed by visiting the Washington Recreation and Conservation Office (RCO) PRISM database. The Lower Columbia Fish Recovery Board manages the SalmonPort database and lists several projects in Wahkiakum County. Some areas have been identified as potential restoration targets (i.e. Steamboat Slough) and several of the island complexes with little or no human activities provide this important habitat and should be evaluated for quality and considered for protection.

Management issues identified in the Estuary and Lower Columbia River & Subbasin Plan are listed below (LCFRB 2010).

- River flow – hydrosystem alterations such as dams, irrigation withdrawals, shoreline anchoring, channel dredging and channelization impact many of the other bullet points listed below.
- Circulation – Changes in salinity distribution may have significant effects on the ecology of fishes in the estuary. Distribution is impacted by tidal and river flow and is strongly influenced by the river flow alterations mentioned in the bullet point above.
- Water temperature and clarity – flow regulation has increased average water temperature in the Columbia River. Increased temperatures impact salmonid migration and may increase the susceptibility to disease.
- Gas super saturation – high dissolved gas levels associated with dam operations have resulted in high levels of salmonid mortality. Measures to reduce the issue have been implemented over the last 40 years, but mortality relating to dissolved gasses linked to water releases is still considerable.
- Water quality (contaminants) - Environmental contaminants have been detected in lower Columbia River water, sediments, and biota at concentrations above available reference levels. Significant levels of dioxins/furans, DDT, and metals have been identified in lower Columbia River fish and sediment samples. In general, contaminant concentrations are often highest in industrial or urban areas, but may be found throughout the lower Columbia River mainstem and estuary as a result of transport and deposition mechanisms.
- Channel alterations and habitat disconnection – diking, channel confinement, dredging and other habitat alterations have contributed to substantial changes to estuary and lower Columbia River habitats since the late 1800's (Thomas 1983). Dredging has significantly impacted channel morphology. Habitat changes has contributed to a loss of natural habitats, reduced woody debris deliveries to rearing habitats, reduced water flow to side channel habitats, a lack of access to productive rearing areas, decreased macrodetritus inputs and food-web productivity, stranding of juveniles behind poorly functioning tide gates, and reduced refuge from predators.
- Sediment transport - Sediments in the estuary may be marine or freshwater-derived and are transported via suspension in the water column or bed load movement. However, the largest single factor in reduced sediment transport is likely the reduction of spring freshet flow from water regulation and irrigation withdrawal. Flow reductions affect estuary habitat formation and maintenance by reducing sediment transport (Bottom et al. 2001, USACE 2001, LCFRB 2010).
- Predation – Directly affects salmonids and other fish species. Increases in predation by human-alterations include the construction of dams and impoundments, decreased water flows, predator habitat creation by overwater structures and at artificial islands, and introduced sport fishes.

Management Opportunities

Each HUC 10 watershed section in Chapter 5 has its own discussion about restoration and protection potential (See each HUC 10 watershed "Restoration Potential and Considerations" section) based on past reports discussed in each HUC 10 watershed section and the Ecosystem-wide analysis completed for Wahkiakum County and Town of Cathlamet. Refer to Table 5.26 for potential management options in WRIA 25. Recommendations are based on the Ecosystem-wide process analysis discussed in Section 2.3 and in APPENDIX D. Many of these management options may be considered for more than one General Recommendation. The Reach Matrix in Appendix A also identifies these management options on a reach by reach basis.

In summary, major impairments in WRIA 25 occur where major development exists such as the Town of Cathlamet, Skamokawa and along semi-impervious or impervious surfaces such as roads and levees. The most impaired areas include lower reaches of these basins where levee construction, floodplain disconnection, agriculture, and cattle grazing contribute to ecosystem process impairments. Lastly, forestry practices, particularly in the upper watersheds of the Grays and Elochoman Rivers, Upper Skamokawa Creek and Mill Creek have contributed to moderate to severe impairments in sedimentation and surface water movement. This is particularly the case in flashy river systems such as the Grays River where massive erosion events occur in the upper system, followed by increased rates of accretion in the lower part of the watersheds causing some land use conflicts (i.e. boating in the lower Grays River). Forestry practices and riparian buffers have improved over the last 10 years. In the lower reaches of these stream systems, protections and improvements should be made to wildlife and salmonid habitat, as well as to private land that currently has eroding banks, vegetation in riparian areas should be reestablished where possible to improve many of the basin-wide processes and functions. In general, the majority of the restoration efforts should focus more on mid- and lower-basin projects, while preservation and conservation efforts should be focused on the least impacted/impaired areas. Some of these areas include the upper watersheds where logging is prevalent, but structure and functions are largely intact and in the lower watersheds where many of the relatively untouched islands on the Columbia River occur.

Table 5.26 General Recommendations and Management Options for the Wahkiakum County Watersheds discussed in Chapter 5*

General Recommendations	Potential Management Options
Protection High Process Importance, Low impairment areas	Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and prohibiting bank hardening
	Limit/avoid no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities
	Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones
	Discourage the removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities
	Develop a planning strategy that maintains ecological function that may including the possibility of minimizing development in the floodplain . Make sure setback restrictions are adhered to.
	Continued protection of critical areas within shoreline jurisdiction
	Maintain the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients
	Prohibit new overwater structures unless associated with a water dependent-use (not including docks or piers)
	Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas
	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer
	Maintain septic systems
	Increase opportunities for land exchanges that retain or restore floodplain and delta habitats
	Maintain native riparian vegetation
	Discourage new shoreline armoring in these areas
Conservation	Continued protection of critical areas within shoreline jurisdiction

High Process Importance, low impairment areas	Protect natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening
	Avoid/limit new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting essential facilities or increasing habitat through bioengineered restoration
	Restrict livestock access to streams and rivers to prevent streambank and vegetation degradation, channel widening and heating where livestock is present
	Discourage new dwelling units or expansion of existing structures within the CMZ
	Avoid/limit development and shoreline modifications that would result in interference with the process of channel migration that may result in a net loss of ecological functions associated with the rivers and streams
	Retain large woody debris in streams and maintain long-term recruitment of large woody debris from riparian zones
	Prohibit removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities
	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer
	Avoid placement of shoreline armor or other structures near the beach, especially waterward of OHWM, that may result in down cutting of the shoreline, substrate change, or alteration of shoreline physical processes Avoid and minimize shoreline armoring projects, and require proposed bulkhead rebuild projects to have a geotechnical assessment, reviewed by a qualified third party, to evaluate problems and analyze potential solutions, including the use of alternative designs (e.g., soft-shore approaches) as opposed to in-kind replacement. For retrofitting projects, bulkheads should be completely eliminated when possible or relocated shoreward of OHWM, and shorelines should be restored with emergent and riparian plant species
	limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation
	Avoid, where possible, the construction of new dikes, levees, tide-gates, floodgates, pump stations, culverts, dams, water diversions, and other alterations to the floodplain, except for habitat improvements such as a wider culvert for fish passage
	Avoid new road construction at stream and wetland crossings
	Maintain vegetation, limit disturbed areas, and control drainage on steep slopes.
	Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible
	Increase opportunities for land exchanges that retain or restore floodplain and delta habitats
	Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas
	Minimize and control runoff and soil erosion
	Maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting
Restoration High water process importance, higher impairment areas	Limit impervious areas
	Repair faulty septic systems
	Minimize nutrient and pathogen inputs to freshwater aquatic areas from animal/human waste and fertilizer
	Coordinate restoration plans with salmonid recovery and watershed management plans, water clean-up plans for TMDLs, stormwater management programs, and with stormwater basin plans where they have been developed
	Restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients
	Restore natural streambank conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening

	Plan for and facilitate removal of artificial restrictions to natural channel migration, restoration of off channel hydrological connections and return river processes to a more natural state where feasible and appropriate
	Restore natural channel morphology
	Increase opportunities for land exchanges that retain or restore floodplain and delta habitats
	Encourage the removal or relocation of structures within the channel migration zone to facilitate the natural recovery of channel migration processes
	Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates
	Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates
	Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible
	Support the removal and control of noxious weeds
	Maintain native riparian vegetation and encourage the restoration of degraded riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting.
	Close unnecessary roads
	Minimize and control runoff and soil erosion
	limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation
Development Low water process importance, higher impairment areas	limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation.

*note: not all recommendations are appropriate for all areas. Evaluation of the Ecosystem Process analysis and further analysis in the field is necessary to specifically determine how management options will work in specific areas.

Management recommendations are based on the ecosystem-wide process analysis discussed in Section 2.3. The reach matrix (APPENDIX A) identifies potential restoration opportunities on a reach by reach basis.

5.8 Data Gaps

Sections 5.1 through 5.6 include some variation of presentation within the document. This is due to the availability of some data types for each watershed. For example, some forms of data such limiting factors and more detailed restoration potential were widely available for the Grays River watershed, but not for other watersheds such as Germany Creek. More data has been collected and evaluated for Grays River, Skamokawa Creek and the Elochoman River than for the other watersheds.

The LCEP land cover data provides more detailed information about land cover along the Columbia River and tributaries. However, the data does not cover the entire extent of the “shorelines of the state” within the WRIAs 24 and 25. As a result, NLCD (2012) was utilized to fill in the data gaps. However the scale and level of detail for the NLCD data are more coarse than the finer-scale information that the LCEP data provides.

Similarly, LiDAR data was available from the U.S. Army Corps of Engineers (2010) but only for the Columbia River and portions of its tributaries. Both 3m and 10m DEMs were used where appropriate to get elevation data for the rest of Wahkiakum County.

The range of availability and scale of data used for the ecosystem analysis is previously described in Chapter 2, where the degree of specificity produces varied results. Lastly, how individual sections are presented may vary depending on the availability information for each waterbody, watershed, etc. For example, the Grays River basin has been extensively studied whereas the information on the Mill Creek area has far less information available. This report makes every attempt to analyze each basin based on the same parameters. Specifics on a particular waterbody may be available when that same information for another waterbody is not. Additional future efforts for similar and related evaluation of shoreline conditions will be supported by improvements in the source data; such efforts may be initiated at the County's discretion or by necessity for future shoreline planning and managagment demands. Agencies and organizations involved in data collection, distribution, and analysis are encouraged to proactively share information with the County to help address existing data gaps.

Chapter 6: Land Use Analysis

6.1 Trends and Future Demand

Wahkiakum County is a small, rural county with a population of 3,978 (2013 Census) and is covered by 85 percent forestry lands, including recently harvested forest. Agriculture, including grazing, represents about 10 percent of land use. Other types of development and urban uses cover less than 5 percent of the county. The vast majority of shoreline jurisdiction is in agricultural, open space, or rural residential use.

The Town of Cathlamet is a small incorporated community with a population of 538 (2013 Census) and is covered by 8.6 percent forested land. Six (6) percent of the current land cover is considered high intensity development, while medium and low intensity development represent another 20.5 and 32 percent respectively, for a total of nearly 59% intensively developed area. Lastly, developed open space represents 13 percent of the land area in the Town. The majority of the Town's shoreline jurisdiction consists of low, medium, and high intensity development including residential and commercial development.

Information was collected from the Town and County during a series of community SMP visioning workshops. Community values for both the Town and County generally include a desire to preserve the shoreline character in terms of the aesthetic and natural attributes. Overall, community members in the Town of Cathlament suggested that planning should be tailored to the needs, challenges and opportunities of smaller rural communities facing economic constraints. They expressed an interest in maintaining the rural, small-town character, while providing additional commercial, service, and recreational opportunities for both tourists and residents. This includes marina expansion, additional overnight moorage, shoreline multi-use paths that would build a nexus between public shoreline access and commercial areas. This includes a connection between shoreline parks and other points of interest with the potential to connect these shoreline trails on a regional/county-wide scale. Additionally, there is a desire to provide opportunities for new development, particularly commercial and industrial uses, to provide employment opportunities in the Town and County. Community members indicated that any new commercial and industrial development on the shoreline should ensure the protection of resources and take reasonable steps to reduce/avoid air and water pollution.

County-wide, community members expressed similar goals for future land use along shorelines. These goals reflect local values to preserve the current shoreline character in terms of the aesthetic and natural attributes, while balancing it with other land uses such as forestry, agriculture, fishing, industry and recreation. Community members expressed a desire to increase public access opportunities via trails, boat access and services, and park space while improving existing public access areas. There is acknowledgement that residential development is drawn to the shorelines in the County, but that agriculture and other private property uses are important parts of the county economy. Certain types of residential development such as condominiums and large apartment complexes do not fit with the rural fabric of the County and that over-water structure redevelopment could be an opportunity to encourage water-dependent and multi-use development throughout the County, particularly in rural centers such as Skamokawa. Overall, the community vision is for shoreline development to accommodate new development as well as redevelopment as part of a desire to grow while maintaining the rural character of the County.

In the County, growth has concentrated in the Elochoman Valley and on Puget Island and is contrasted by slight population loss in the Town. The rural center of Skamokawa's population has been stable at about 447 (2007 Census). The west end of the County lost population in the 1990's, but accounted for a third of building permits in the between 2000 and 2010. A review of aerial images from 2005 through 2014 did not reveal obvious locations of new development within the Puget Island and Elochoman Valleys, so no conclusions can be drawn on the extent to which development is occurring within shoreline jurisdiction along stream banks or more generally within the floodplains. County permit data confirms that Puget Island and the Elochoman Valley have been where the bulk of new development has occurred over the last 15 years. Other areas of growth on the shoreline includes the Skamokawa rural center. The bulk of the shoreline permits on Puget Island have been for individual docks.

Subdivision of land to lots ranging in size from one to five acres for residential development is occurring within the County's shorelands, but outside of designated growth centers. Areas of development tend to be within 100-year floodplains. Larger agricultural parcels are slowly being subdivided and converted to low density rural residential (typically one unit per 0.25 to 1 acre) particularly on Puget Island and in the Elochoman Valley.

Population projections indicate a slight population increase in the Naselle River valley (WRIA 24). This includes a small land area in Wahkiakum County, although most of that growth will likely occur near the rural center of Naselle, WA in Pacific County (Pacific County Comprehensive Plan 2010).

Table 6.1 Housing Unit Growth Projection based on OFM Estimates, County and Town

Year	Housing Units	Difference from Present
2010	2,067	
2015	2,127	
2020	2,189	
2025	2,252	
2030	2,318	
2035	2,385	258

Table 6.2 Annual New Privately-Owned Residential Building Permits, County and Town[1]

Year	New single family units	New two or more family units	Total*
2010	11	0	11
2011	10	0	10
2012	5	0	5
2013	12	0	12
2014	11	0	11

* Of all new residential building permits, reported, only one, in 2013, was within the Town of Cathlamet.

Washington OFM's 2015 population estimate for the purposes of allocating state revenues indicates a countywide population growth of only two people from 2010 to 2015, and a Town of Cathlamet

[1] US Census Bureau. Building Permits. http://censtats.census.gov/bldg/bldgprmt.shtml

population loss of 42 people[2]. These data suggest that WA OFM's 2012 forecasted trends of population loss or very modest gain remain applicable for purposes of shoreline planning in 2015.

Washington OFM estimated that the number of housing units in Wahkiakum County would grow from 2,067 in 2010, to 2,127 in 2015.[3] Extrapolated to 2035, the WA OFM forecast suggests that there will be 2,385 housing units, which is 258 more than in 2015, or about thirteen to fourteen net new housing units per year (See Table 6.1). These estimates are consistent with building permit data reported by Wahkiakum County and Town of Cathlamet to the US Census Bureau.

Table 6.3 Permitted Dwelling Units

Year	**Shoreline SFR Building Permits Issued: County & Town**
2005	8
2006	14
2007	10
2008	1
2009	4
2010	1
2011	2
2012	1
2013	5
2014	2
Total	**48**

For the nine year period from 2005 through 2014, County and Town permit data shows there were 48 single family residential building permits issued in shoreline jurisdiction. Projecting the same rate for a twenty-year forecast (2015 to 2035), there would be an additional 121 single family residences in shoreline jurisdiction anticipated, or about 5.3 shoreline homes per year.

However in the 2010-2014 period of economic downturn when there were 49 new residential dwelling building permits issued throughout the County and Town, 11 of those permits were issued for new residential development in shoreline jurisdiction. If future shoreline residential development mirrors the slower 2010-2014 trend (2.8 new shoreline homes per year), there would be just 56 new shoreline homes anticipated by 2035, less than half the number of projected new shoreline residences forecast by the higher growth rate.

Between 2000 and 2014 there were approximately 86 shoreline permits issued in the County and Town, averaging 5.7 per year. This does not include building permits for single family residential (SFR) development discussed in Table 6.3; SFR shoreline development does not require a shoreline permit per the SMP but does require a building permit per Town and County code. Many of the shoreline permits were for public projects such as bridge replacements, dredge material disposal, and ecological restoration. There were five permits for erosion control and bank stabilization, and 27 that included docks. There were four permits issued for new commercial or industrial uses and

[2] WA OFM population estimates. http://www.ofm.wa.gov/pop/april1/default.asp
[3] WA OFM housing estimates. http://www.ofm.wa.gov/pop/april1/default.asp#housing

structures, primarily in Skamokawa and the Town of Cathlamet. Other project types represented by the remainder of permits included:

- Bridge
- Water, sewer transportation and telecom systems
- Boat ramps
- Gravel bar removal
- Restoration
- Dredging and dredge material disposal
- Forest practices bridge

Naselle and Salmon River Subbasins
Uses are predominantly agriculture, rural residential and forestry. Riparian areas buffer much of the agriculture and residential use from the waterway. Rural residential and agriculture uses are more dominant on the Salmon River shoreline, whereas managed or riparian forest is more dominant on the Naselle shoreline. Future demands? Appendix A Reaches include: NW_Naselle_01 – 02 and NW_SalmonCreek_01 – 03.

Deep River Subbasin
Uses are predominantly agriculture and rural residential, with residential and commercial uses at more urban densities occurring in the unincorporated town of Deep River. Roads on top of dikes follow the majority of the Deep River's shoreline, up to the town of Deep River from the mouth. There is an inactive log sorting facility along SR 4 halfway between Deep River's mouth and the town of Deep River, and a cluster of rural residential development within 200 feet of the river shoreline downstream from the log sorting facility. Very limited future subdivision and rural residential development is expected within 200 feet of subbasin shorelines and within the 100 year floodplain as a whole. Appendix A Reaches include: WFC_DeepRiver_01-09, WFC_HalayaSlough_01, and WFC_RangilaSlough_01.

Grays River Subbasin
Uses are predominantly agriculture, with residential and commercial uses at more urban densities occurring in the unincorporated town of Grays River. Rural Residential development is noticeable in the two miles upstream from the Grays River rural center. Within 200 feet of the shoreline, primary uses are agriculture and riparian forest open space. Homes and buildings associated with agriculture are typically not within 200 feet of the shoreline. However, many of these structures are in the 100-yr floodplain.. There is a very large livestock facility ½ mile downstream from the unincorporated rural center of Rosberg. Intermittently, county roads travel along the Grays River subbasin's shorelines. Upstream from SR 4, primary shoreline land use transitions to forestry along the mainstem and surrounding the braided stream channel.

Skamokawa Subbasin
Uses in the shoreline jurisdiction including the 100-year floodplain are predominantly agriculture, with residential and commercial uses at more urban densities occurring in the unincorporated town of Skamokawa. Uses within 200 feet of subbasin shorelines are overwhelmingly agricultural. A large portion of rural single-family homes and buildings are within 200 feet of subbasin shorelines. Upstream from the town of Skamokawa there are no development centers.

Elochoman Subbasin

In the mid and lower reaches, uses in the shoreline jurisdiction including the 100-year floodplain are predominantly agriculture, with residential development occurring in many places. Residential development and agriculture are both common land uses within 200 feet of subbasin shorelines. The development trend in the Elochoman Valley over the last decade has been a conversion of agricultural land to smaller-subdivided lots for hobby farms and increased residential development. The upper reaches of the Elochoman and its SMA tributaries are dominated by forestry practices. Logging roads frequently cross waterways which often flow through culverts under the roads. Appendix A Reach Matrix details land use and land cover descriptions for all shoreline reaches.

Lower Columbia River subbasin (Baker Bay and Cathlamet Channel)

The Lower Columbia River subbasin land uses include industrial, agricultural, open space, and rural residential development. Skamokawa, at the mouth of Skamokawa Creek, Puget and Little Islands and the Town of Cathlamet are the population centers in the County along the Columbia River. Land uses in these areas include primarily residential and some commercial development with some industrial development in the Town of Cathlamet (land uses in the Town are described in further detail below). The Julia Butler Hansen National Wildlife Refuge, between Skamokawa and the Town of Cathlamet provides some active cattle grazing but is primarily managed as open space for priority habitat. A large portion of the shoreline along the Columbia consists of steep forested bluffs or is bordered by SR 4. SR 4 is a travel corridor that connects several commercial developments in areas such as Deep River and Skamokawa as well as rural residential developments along the shoreline. SR 4 also has access to a county park and several informal public access locations along the Columbia River. Lastly, logging in the uplands near the shoreline of the Columbia River is common, particularly between Grays River and Skamokawa. An additional center of population density in East Cathlamet is located functionally adjacent to the incorporated Town of Cathlamet but almost exclusively outside shoreline jurisdiction. Populations on Puget Island and the lower Elochoman Valley are within approximately two miles of Cathlamet.

Town of Cathlamet

Cathlamet is home to about 13 percent (532) of the County's residents. The 2010 population was down 5.8 percent from 565 people in 2000.

Urban development with increased densities in the Town of Cathlamet and East Cathlamet are adjacent to approximately 1.5 miles of Columbia River's Cathlamet Channel. The shoreline along the Town of Cathlamet from northwest to southeast is described below.

Reaches CC_Columbia_09 and _10: A two acre forested area occupies the northwestern most shoreline, between SR 4 and the Elochoman Slough of the the Columbia River. South of this land is unused open space, or grazing land. An inactive log sorting yard is located south of this area. On the southern half of this property are 125 feet of shoreline bulkhead, two docks, and another 50 feet of shoreline bulkhead. The area described above is zoned "Commercial/ Industrial."

While more intensive future commercial and industrial uses could be permitted in this area per the zoning code, it is equally likely that the existing uses will continue, or that the area will be redeveloped with residences at permitted urban densities up to one unit per 7,500 square feet or approximately 5.8 units per acre ('5:1'). The minimum lot sizes in the commercial/industrial zone for commercial and industrial uses are 5000 square feet, residences are permitted in the zone, however the minimum dimensional standards for residential development apply. For comparison, the existing residences south of the log sorting yard don't meet these lot width requirements. Two waterfront parcels in the area could potentially be subdivided fo commercial/industrial use, provided the minimum commercial/industrial dimensions are met.

Located southeast of the log sorting yard is an area zoned "Commercial" with 550 linear feet of residentially developed shoreline parcels , includingthree docks. The six homes and the docks have all been built since 2006 and four lots are currently vacant. This area will likely remain in residential use at existing densities.

Between this residential development and the Elochoman Marina to the south, are 300 linear feet of parking and boat trailer storage, and 500 feet of steep forested slopes bound landward by SR 4. The Elochoman Marina has moorage space for 300 boats, a boat ramp, and parking for thirty vehicles connected to trailers. There is also RV, tent and yurt camping along the armored breakwater and rental cabins just upland from the docks.

Reach CC_Columbia_11: Decommissioned wastewater treatment lagoons occupy the shoreline area between the marina and the Birnie Creek mouth. Future redevelopment of the public property is of great importance to residents with public access, water-dependent, and other mixed uses of local interest prioritized. Ongoing community dialogue will guide the vision for this prime waterfront location. Birnie Creek is not an SMA stream itself, but is located in shoreline jurisdiction and has relic structures from past fish enhnacment efforts. It is not likely such activities will continue and there are restoration opporutnities further discussed in Chapter 7 and the separate Restoration Plan.

Reach CC_Columbia_12: Industrial and outdoor storage uses occupy the shoreline area immediately south of Birnie Creek; these are not water-oriented uses. Next to the south is approximately 700 feet of commercial and industrial piers that serve commercial vessels. South of these, a salmon stock enhancement net pen facility is located at the Town dock year-round for seasonal use. The area described above, from the Port's trailer parking/storage lot south to the vacant road right-of-way (ROW) easement just north of the bridge is zoned "Commercial/Industrial." These areas will likely remain in commercial or industrial water-dependent use or could be converted to residential use at permitted densities up to one unit per 5,000 square feet (8:1) as allowed by the Town's municipal code

From the vacant road ROW south past the SR 409 bridge to the Town's eastern boundary at Jacobson Road the zoning is "Residential". Single family residential uses set back from steep and sometimes cliff like river bank slopes predominate at densities of one home per 1/8 acre to one home per ¼ acre (i.e. '8:1' and '4:1' respectively). Landward of these homes outside of shoreline jurisdiction is Columbia Street running parallel with the shoreline, and more homes at similar densities landward from Columbia Street within the shoreline jurisdiction. This area will likely remain in residential use, with the possibility for residential redevelopment, but with very limited potential for further subdivision under current zoning regulations.

Other than the several residences northwest of the marina, no new buildings have been added to Cathlamet's shorelines since 2005 according to the Town's shoreline permit data,. One over water building appears to have been removed from the area south of the Town dock (old ferry terminal), and two docks appear to have deteriorated in the same area.

6.1.2 Demand for Water-dependent Uses

Wahkiakum County's Draft Comprehensive Plan (2008) summarizes future capital facility and utility projects. Table 6.3 presents a subset of these proposed projects selected for their inclusion of water-dependent and other water-oriented uses and development , proposed location within shoreline jurisdiction, or projects that would be a driving factor for additional future shoreline development. The table provides an informal project name and selected project details organized by geographic area.

Table 6.3 Capital Facility Projects Identified in Draft Comprehensive Plan

Altoona	**Project Description**	**Use Type**
Recreational Improvements	• Identify suitable locations for public access to recreation along the Columbia River waterfront (e.g. viewpoints, trails, beach access, camping, moorage)	Water enjoyment, public access
	• Identify suitable locations for viewpoints and visitor pull-outs	Non-water oriented, public access
Cathlamet Channel	**Project Description**	**Use Type**
Cathlamet Channel Sedimentation	• 20' Downstream Barge Channel & maintenance	Water-Dependent
	• Upstream Small Boat Channel & maintenance	
Cathlamet Marina Sedimentation	• Flow Improvement & maintenance	Water-Dependent
	• Maintenance Dredging & maintenance	
	• Breakwater Rehabilitation & maintenance	
City Dock Improvements	• Evaluate potential uses and suitable activities.	Water-Dependent, Water-Related, Water Enjoyment, Non-Water Oriented
	• Identify improvement, development and maintenance costs.	
Elochoman Conference Center	• Feasibility study & implementation plan to identify support activities for marina	Water-Dependent, Water-related, Water Enjoyment/non-water oriented development
	• Market study to determine niche for a motel/ conference center facility	Non-Water Oriented Development
Marina Improvements	• Boardwalk (200 linear feet) and viewing platform	Water-enjoyment/public access
	• Install two – four "park model" units for overnight visitors	Water-enjoyment/public access
	• Add and pave 10 additional RV spaces	Non-Water Oriented Development

	• Land parcel swap with Cathlamet	N/A
	• Electrical hookups for moorage area	Water-enjoyment
	• Pave parking area and RV spaces	Non-Water Oriented Development
Museum Feasibility Study	• Assess collection	Non-Water Oriented Development
	• Recommend capital improvements	Non-Water Oriented Development
Port No. 1	• Add 20-30 permanent moorage slips when main floats replaced	Water-Enjoyment
Waterfront Revitalization Study	• Evaluate potential sites and buildings for industrial/ commercial/tourist redevelopment, focusing on river-based business and industry.	Water-Dependent, Water-Related, Water Enjoyment, Non-Water Oriented
	• Identify appropriate incentives for private development/ redevelopment.	
Deep River	**Project Description**	**Use Type**
Deep River Navigation	• Local dredging and maintenance	Water-dependent
Bikeway Trails	• Biking & walking trail along Oneida Road/Deep River Road	Non-water oriented use/Public access
Oneida Boat Ramp & Park	• Since the Draft of the Comprehensive plan, WDFW acquired the property and has improved parking, added a new dock and constructed a new bathroom.	Water enjoyment, public access
Weyerhaeuser Sort Yard	• Reuse study for 75-acre tract/former sort yard	Water-oriented/Nonwater-oriented
Grays River	**Project Description**	**Use Type**
Grays River Grange Park	• Acquire land, develop tourism park/commercial area	Water-enjoyment/nonwater-oriented use
Grays River Erosion Control	• Phase II Erosion Control Structures: protect water system and correct erosion w/in-stream structures	Water-Dependent/Non-water oriented
Grays River Channel Sedimentation & Flood Reduction	• Dredging & annual maintenance	Water-dependent
Recreational Improvements	• Rosburg Boat Launch Signs, annual maintenance	Water-enjoyment
	• Sports Fishing Trails along banks of the Grays River	Water-enjoyment
Western Wahkiakum Water System Extension	• Extend water system to Deep River area	Water-related use
	• Add 60-100 new service connections	non-water related use
	• Regular, systematic leak detection audit prior to leak repair program	non-water related use

General	**Project Description**	**Use Type**
Countywide Trails Network	• Identify natural/built corridors for pedestrian, bicycling, equestrian use; potential routes, needed improvements, and costs.	Water-enjoyment, nonwater-oriented use, public access
Waterfront Public Access & "Ports of Call"	• Study to identify existing and potential sites for expanding public access to the waterfront for recreation. Include fixed locations as well as trails.	Water-enjoyment/nonwater-oriented use
Puget Island	**Project Description**	**Use Type**
Bank Erosion	• Option two: sheet pile wall	Water-related
Bank Erosion	• Nourishment	Water-related
Brown Slough Pump Station	• Construct revetment	Water-related
County Sand Pit	• Option one: $70,000 annual maintenance	Water-related
Coffee Pot Island	• Transient moorage float w/ beach access, primitive campground, compost toilet, designated fire pits	Water-related, water-enjoyment, nonwater-oriented
Deficit of Dredged Material	• Option two : $19,000 annual dredge & disposal costs	Water-related
Ferry Terminal Sedimentation	• Coordinated dredging (-0- annual maintenance)	Water-dependent
	• Advanced maintenance dredging ($3,800 annual maintenance); Possible disposal at Pancake Point w/ Advanced Dredging option	Water-dependent
Grove Slough Tide Gate Sedimentation	• Dredging with $3,800 annual disposal costs (in-water) or $19,000 annual disposal (upland)	Water-dependent
North Welcome Slough Road	• Option one: Construct revetment	Water -related
Pancake Point Shore Erosion	• Option one: Hopper Dredge & Beach Nourishment	Water-dependent
	• Option two: Pipeline Dredge Beach Nourishment	
	• Option three: Buried Rock Revetment	
Puget Island "Wind Park"	• Transient moorage & camping facility near dolphins south of Nassa Point for boaters and sailboarders, offering deep water & wind protection	Water-related, water-enjoyment, nonwater-oriented
Svensen Park	• Boat ramp, restroom, vehicle/trailer parking, picnic area	Water-enjoyment
Wahkiakum Ferry Landing Services	• Study to evaluate marketability & costs to develop support activities (e.g. food service, bike/jet ski/paddle rentals)	Water-related, non-water oriented, public access, water-enjoyment
Skamokawa	**Project Description**	**Use Type**

Recreational Trails	• Bikeway Trails -SR 4, JBH Refuge to Steamboat Slough Rd.	non-water oriented, public access
	• Sports Fishing Trails Along banks of Skamokawa Creek	water-enjoyment
	• Barrier Free Shoreline Trails - Barrier-free public access along Columbia River	non-water oriented, public access
	Waterway Trails – Brooks Slough, Skamokawa Creek	water-enjoyment, public access
Skamokawa Creek Dredging	• Maintenance dredging at mouth of Skamokawa Cr./Brooks Slough	Water-dependent
Skamokawa Creek Channel Sedimentation	• Local dredging for flood control, recreation/ commercial purposes and maintenance	Water-dependent
Skamokawa Harbor	• Market/feasibility study to identify services needed to support sport & commercial fishing (haul-out facility, commercial freezer, etc.)	Water-related, water-dependent
Steamboat Slough	• 2-lane boat ramp, courtesy dock, moorage facility, transient moorage dock; pump-out station, fuel dock	Water-related, water-enjoyment, non-water oriented
Vista Park Boat Launch	• Dredging, ramp, dock/moorage facilities, services, maintenance	Water-related, water-enjoyment, public access

6.1.3 Parks and Recreation
Parks and recreation areas with public shoreline access were inventoried from Wahkiakum County's Draft Comprehensive Plan, beach areas off the JBH NWR, and on Puget Island, as well as the Lower Columbia River Estuary Partnership's Lower Columbia Water Trail Map. The inventory provides a list of existing public access areas and whether these access areas are adequate to meet future demand/trends based on the types of use, location, and accessibility.

County Line Park
The park is approximately six acres and has 3,000 feet of shoreline. The Park is the easternmost boat launching and camping site in the County and on the Columbia River Water Trail.

Strong Park & Waterfront Trail
This two acre park is located on the Town of Cathlamet waterfront on the shoreline of the Columbia River adjacent to the Wahkiakum County Museum. The trail crosses Bernie Creek and the G. Alan Johnson lighted "waterfront trail", connecting Strong Park to the Elochoman Marina and to the Columbia River beach area.

Elochoman Marina
The moorage basin is operated by Wahkiakum Port District One, and has moorage for 300 vessels, including 10 live-aboards as well as RV, tent, and yurt camping and rental cabins.

Cathlamet Public Dock
This pier, gangway, and dock provides day use boat and pedestrian access and limited overnight moorage with a permit, but no ramp to the Columbia River. This public facility is available from April through September when not in use by the salmon stock enhancement net pens. Net pens in this location is a land use conflict for some community members who think that the public docks should be available year-round.

Cathlamet Overlook
This scenic vehicle pullout from SR 4 west of Cathlamet above the Elochoman Slough provides views the marina, the town and the Columbia River.

Beaver Creek Fish Hatchery
This hatchery at the confluence of the Elochoman River and Beaver Creek was identified in the 1993 public access plan, however no descriptions were provided. The site is state-owned property, but the fish hatchery has been decommissioned. The property provides an unofficial turnout parking near the building structures with visual and unmaintained foot-trails leading directly to Beaver Creek. This could be better maintained in cooperation with WDFW. There is an opportunity at this location to provide facilities and services for residents and visitors who utilize this site, including maintained pathways to the creek and appropriate signage.

Buffington Memorial Park
Located at the end of SR 409 adjacent to the Wahkiakum Ferry Landing on Puget Island, this pocket park has two picnic tables, a dog exercise area, and portable toilet.

East Tip Puget Island
The Lower Columbia Water Trail map identifies a primitive camping opportunity on the eastern tip of Puget Island accessible by boat only.

Svensen Park
A boat ramp, boat trailer parking, restroom and picnic area are planned for this four acre park under development by Wahkiakum Port District Two located on Puget Island at West Sunny Sands Road, near its intersection with SR 409.

Julia Butler Hansen National Wildlife Refuge for the Columbian White Tailed Deer
The 5,600 acre refuge offers wildlife viewing, an interpretive center, and camping. There is a 5 mile loop through the Wildlife Refuge for hiking, biking or driving.

Brooks Slough Boat Launch
Located at Milepost 39 on SR4 east of Skamokawa, this 2.5 acres site hosts a small boat launch with limited parking. This water trail can be used to explore the Wildlife Refuge.

Skamokawa Vista Park
This full-service campground for RV's and tents is over 70 acres along the Columbia River. It includes small boat launch facilities, hiking trails, and expansive views of the Columbia River, along with some non-water related experiences.

Wahkiakum County Fairgrounds & Day Use Park

The Fairgrounds are located adjacent to Skamokawa River, across the river pedestrian bridge and across SR 4 from Vista Park.

Ahlberg Park
The park is located on the south side of the Grays River Covered Bridge and includes 5 acres of waterfront property.

Wilson Creek Park
This 20 acre park on Wilson Creek (tributary to Skamokawa Creek) has a picnic area and a boat ramp.

Rosburg Boat Launch
Located behind the Rosburg Community Hall, this boat launch on the Grays River is the only one in the area.

Grays River Park
This park is identified in the 1993 public access plan, but includes no discussion or location reference. The park is located near the Grays River Grange and has an unmaintained boat ramp, parking areas.

Grays River Hatchery
This hatchery north off SR on Hull Creek Road has public shoreline access opportunities and viewing opportunities.

Salmon Creek Roadside Park
Located between SR4 Mileposts eight and seven , about three miles west of Deep River. Some overnight camping is permitted, but the park is unimproved.

Table 6.4 Planned or potential shoreline recreational access improvements projects

Project	Project Description	Use Type
Bikeway and Walking Trails	Non-motorized multi-use trails at Oneida Road, Deep River Road, along SR 4 from Cathlamet to Skamokawa, from JBH NWR to Steamboat Slough Rd, and along SR 409 from the JBH Bridge to the Wahkiakum Ferry Landing.	Water-related, Water-enjoyment, nonwater-

		oriented, public access
Cathlamet River Walk	A river walk within the Town along the Shorelines of the Columbia River	Public Access
Countywide trails network	Identifying corridors and needed improvements for pedestrian, bicycling, and equestrian trails. Specifically recommended the Grays River Covered Bridge area, Pillar Rock, Grays River, and Skamokawa Creek as features to incorporate into the network. Network could connect with the Town of Cathlamet River walk.	Water-related, Water-enjoyment, nonwater-oriented, public access
Sternwheeler and Tour Boat Ports of Call	Cathlamet City Dock, Elochoman Marina and Skamokawa as potential ports of call for sternwheeler or other tour boats.	Water-related
Streets that end at the shoreline	Streets such as Broadway St. and Tug Boat Alley in the Town of Cathlamet.	Water-related, Water-enjoyment, nonwater-oriented, public access
Water Trails	Potential stream access trail locations are located at Brooks Slough, Skamokawa Creek Welcome Slough (Puget Island), Cathlamet Channel, Grays River, Deep River and Grays Bay. Development would include put-in and take-out access, fish cleaning stations, shoreline camping opportunities, parking, and signage.	Water-enjoyment, Public access

6.2 Potential Use Conflicts/Management Issues

Part of the land use analysis involved evaluating conflicts between different land uses as well as conflicts between land uses and ecological functions. The sections below describe different land uses and the potential use conflicts. See Table 6.4 for a summarized description of management issues and use conflicts in Wahkiakum County and the Town of Cathlamet.

6.2.1 Agricultural Uses

Per State law, existing agricultural activities on agricultural lands are not retroactively subject to updated SMP standards, buffers, and setbacks. However, new agricultural activities on non-agricultural lands, non-agricultural activities on agricultural lands, and conversion of agricultural land to non-agricultural uses will need to comply with all applicable provisions. In Wahkiakum County, agriculture uses are slowly being replaced by residential uses on Puget Island and in the

Lower Elochoman Valley. This creates opportunity for conflict between adjacent types of land use and reduces the agricultural viability due to reduced production area. Protecting the local agricultural heritage was an issue of importance identified at SMP visioning meetings. The County's Draft Comprehensive Plan proposes multiple tools to protect the local agricultural economy from increasing tax rates, nuisance complaints, subdivision of land, and other threats to agriculture resulting from rural residential development.

An overriding value expressed in the Draft County Comprehensive Plan that might be compromised in the shoreland areas is the maintenance of rural character. Zoning is typically one of the most important tools used to achieve comprehensive plan goals and policies. Wahkiakum County has subdivision, floodplain management, critical areas, and water and wastewater ordinances, but not a zoning code that explicitly manages varying types of uses in different zones. Although critical areas and floodplain management regulation do manage residential growth to some extent, they would not prevent slow but extensive subdivision and development of the County's agricultural areas to lots as small as an acre even in the absence of public water and wastewater utility services.

Agricultural operations can impair the shoreline environment by polluting it with pesticides, sediments, and animal waste. Agriculture can also impair the shoreline environment by impairing natural hydrological functions, reducing shoreline shade trees, and reducing potential for recruitment of large woody debris. Adherance to best management practices with the assistance of the Consrvation District and other entities helps minimize impacts to important watershed processes and shoreline functions.

Conflicts with other land uses include large rural tracts of agricultural land that limit public access to SMA waterways, particularly in the floodplain areas. Agriculture has played an important economic driver in the County since the late 1800's often at the expense of ecological functions (i.e. building of levees and a system of drainage canals). Over the last 15 years, the County has seen increased interested in restoring some of these lands to historic intertidal wetland habitat, which benefits the recreational and commercial fishing industry. Recently, there has been some push-back from the community about what restoration projects are acceptable and their effects on private property, particularly agricultural land. These conflicts will likely continue into the future and can be addressed through separate planning processes.

6.2.2 Dams

On three occasions since the 1950's, the PUD has considered constructing a dam in the Grays River to generate hydroelectric power. In 2001 the idea was proposed by Energy Northwest, a private entity created in 1957 to construct power plants. The upper and lower ends of the Grays River gorge have been examined for such a facility. Dams such as the one most recently proposed would minimize flood risks downstream, but would disturb the natural hydrological cycles, have associated habitat impacts, and preclude opportunities for floodplain and habitat restoration. Upstream from the dam, any shoreline and shoreland areas would be completely transformed as submerged portions of the resulting reservoir.

Dams would also have a potential impact on recreational use in the waterways. As boating opportunities up and down the waterway would be limited to certain sections of the river/stream.

6.2.3 Dredge Disposal

Dredging and dredge disposal can harm or destroy aquatic and shoreland terrestrial habitats, by physically changing them, or by polluting them with disposed or disturbed sediments. Improved shipping channels allow vessels to travel at higher speeds, which can increase shoreline erosion, such as that which has occurred at Pancake Point and Welcome Slough.

Neglected or discontinued maintenance dredging at the confluence of local rivers and the Columbia has created problems with sport and commercial vessel traffic. The forces of sedimentation and erosion have different sources and dynamics. This has resulted in imbalances of erosion in upper watersheds such as Grays River and accretion rates in lower reaches such as Grays Bay. This has resulted in more extensive flooding than in years past, and loss of private property.

Beneficial dredge material placement, such along the southern parts of Puget Island, is welcomed by many residents in an attempt to protect private property from bank erosion. However inland places on Puget Island, dredge disposal is not a preferred use. Additionally, dredge material used for beach nourishment helps to create shoreline access opportunities in areas such as at Skamokawa Park.

6.2.4 Residential Development

Residential development including in-water and over-water structures in shorelines can impact water quality, water quantity, rural and natural shoreline character, and restoration opportunities, water dependent use opportunities, and other values.

Residential development served by on-site septic systems can degrade ground water quality Through improper siting, poor design, faulty construction and incorrect operation and maintenance creating health risks in nearby drinking water. Residential development served by wells can withdraw excessive water from the ground, reducing in-stream flows, and exacerbating temperature and dissolved oxygen conditions causing serious degradation of habitat, especially for salmonids.

With some exceptions, private wells can be drilled and draw up to 5,000 gallons per day without a state water right permit for domestic, agricultural and/or industrial use. Lots as small as an acre are typically allowed to use private wells. Taken with wastewater restrictions that allow septic systems on lots as small as an acre, there is an effective minimum rural residential lot size of one acre and resulting density of 1:1in the absence of zoning or shoreline management controls to the contrary.

Residential development along the Shorelines in Wahkiakum County may conflict with other desirable uses such as water-dependent commercial and industrial uses when homeowners are dissatisfied with the occasional or ongoing lighting, noise, sights and smells of non-residential neighbors . Many homes in the County are 2nd or 3rd homes for people who live in other parts of the Pacific Northwest. Any increase in vacation home development would reduce the available shorelines suitable for other types of development that would otherwise increase jobs and the economy in the County and Town.

6.2.5 Flood Management and Habitat Restoration

Traditional forms of flood management such as levees conflict with some natural functions, including naturally meandering stream channels, off-channel habitats, production and deposition of large woody debris, and riparian ecosystem functions. The County currently has a moratorium on levee breaches. Levee breaching can play an important role in restoring floodplain and habitat functions. The Wahkiakum County can use the Shoreline Management Plan to create a framework for restoration and levee breaching projects that will be acceptable to local stakeholders without unnecessarily preventing the selective application of levee breeches. State and federal resources are available to assist community floodplain management through planning and risk reduction.

Several restoration activities throughout WRIA 25 have been proposed, identified or completed. APPENDIX A identifies proposed or existing floodplain restoration and management activities by reach. Restoration activities exist or are planned on Deep River, Grays River, Skamokawa Creek, the Elochoman River, and some of their SMA and non-SMA tributaries.

The Julia Butler Hansen National Wildlife Refuge is located between Skamokawa River and the Elochoman River and totals over 6,000 acres. The Refuge includes pastures, intertidal forested wetlands, brushy woodlots, marshes and sloughs and protects that portion of the Columbia River, a Shoreline of State-wide Significance, , including substantial portions of Steamboat Slough, and Brooks Slough. The land is federally owned and was originally established to provide protected habitat for the federally listed endangered Columbian white-tailed deer (*Odocoileus virginianus leucurus*). The Refuge has also implemented a number of tidegate replacements/upgrades and a floodplain restoration project that breeched sections of the levee to reconnect the Columbia River to a portion of the floodplain on the Refuge.

6.2.6 Forest Practices

Forestry activities in Washington are primarily regulated by the Forest Practices Act (FPA) (RCW 76.09) and implementing rules (WAC 222.08). A forest practice activity consisting of timber cutting only is not considered development under the Shoreline Management Act (SMA) and does not require a shoreline Substantial Development Permit, but is regulated under the FPA.. However, forest practices such as building roads, trails and bridges and replacing culverts are considered development under the SMA and are regulated under local Shoreline Master Programs as well as the Forest Practices Act. The SMA does not exempt these forest practices from the requirement for a Substantial Development Permit (SDP) (Ecology). Shoreline Master Program standards, including buffers and setbacks, apply to forest practices that are considered development. These forest practices are not exempt from local master program standards. Further, conversion of forest lands to other types of land use must comply with the SMA and local SMP provisions.

Potential shoreline use conflicts may exist in portions of the County where forestry is the principal use because of the noise, downstream flow and sedimentation changes, and logging operation traffic to/through residential areas. Forest land conversion could result in residential development in close proximity to active harvest areas, with potential for conflict over noise, hauling traffic, surface water issues, etc. In order to help address conflicts with ecosystem processes, forest practices in the county must be consistent with riparian buffer requirement between the Forest Practices Act and the SMA. Department of Natural Resources (DNR) Forest Practices Applications (FPAs) are required to be consistent with the SMP. The County currently requires a Shoreline Permit for any proposed DNR timber harvest, culvert installation, and/or road construction within the Shoreline jurisdiction (200' from OHWM). However, under the current SMP, there are minimal harvest guidelines except within shorelines of statewide significance (SSWS). The updated SMP will need to comply with the minimum standards in the state Guidelines (WAC 173-26-241(3)(e) and others as applicable).

6.2.7 Log Storage

Two inactive log storage and processing facilities exist; one on the Lower Deep River (Reach: WFC_DeepRiver_07) and one at the northwestern edge of the Town of Cathlamet on the Elochoman Slough - Columbia River (Reach: CC_Columbia_09). Traditional practices primarily utilized in-water log boom operations for downstream transport; however current transport of logs utilizes trucking routes on State Route 4. Both of these facilities have remnant docks and piers left over from previous times when logs were shipped up or down the Columbia River for processing/export. Since the log sorting yards no longer use water transport to move logs, log storage and log sorting are no longer water-dependent or water-related uses, and therefore not preferred shoreline uses under the SMA. Management issues include water quality resulting from a large impervious surface and excess nutrient input from left over piles of wood waste. A restoration or redevelopment opportunity on private and/or public lands would be to evaluate the overwater structures and determine whether or not they would provide a public access orwater-dependent commercial/industrial redevelopment benefit or whether the demolition & removal of these structures would provide a better opportunity for habitat restoration.

6.2.8 Outfalls

Several outfalls exist throughout the County mostlyin and around the Town of Cathlamet. Water quality impacts from point-source pollution may result from discharging wastewater or storm water runoff from outfall pipes into waterways. Potential use conflicts and management issues include health and safety risks to recreational users of the waterway, degraded habitat and contaminated fish. One functional outfall pipeline exists near the location of the decommissioned waste water treatment facility (sewer lagoons) in the Town of Cathlamet (Reach: CC_Columbia_11). Other outfall locations include:

1) The Town dock on Broadway St has a large pipe with a rubber 'duck bill' type valve (Reach: CC_Columbia_12)
2) Close to the Courthouse near the footbridge across the lagoons—feeds into the wetlands (Reach: CC_Columbia_11).
3) There is another outfall on the opposite side of the lagoon wetlands, on the other side of the walkway, closer to houses than the foot bridge (Reach: CC_Columbia_11).
4) Tug Boat Alley near the sewer lift station (Reach: CC_Columbia_11).

Management considerations include effective onsite stormwater treatment and infiltration and compliance with wastewater treatment requirements to minimize contaminant discharge.

6.2.9 Overwater Structures

Overwater structures are common in the lower sections of major tributaries to and sloughs of the Columbia River and include docks, piers, covered moorage, storage buildings/homes built on docks or piers, and houseboats/floating homes. Areas where overwater structures are concentrated include populated areas such as lower Deep River, lower Grays River and at the rural centers of

Rosburg and Grays River, lower Skamokawa Creek, Brooks Slough, main stem of the Columbia River at the Town of Cathlamet, and Birnie Slough, Welcome Slough on Puget Island. Private and public docks are also scattered along the Columbia River and its tributaries..

An area of potential use conflict includes Welcome and Birnie Slough where a lot of the County's growth is occurring. Private docks associated with residential development are typically allowed, and are considered exempt from obtaining a shoreline permit under certain conditions (WAC 173-27-040(h)). However, the SMA Guidelines at WAC 173-26-231 also direct updated SMPs to (b) "Reduce the adverse effects of shoreline modifications and, as much as possible, limit shoreline modifications in number and extent." Large concentrations of piers and docks can create conflicts with other SMA preferred uses by degrading shoreline ecological functions, limiting the potential for recreation and restoration, and potentially interfering with navigation as a normal public use of public waters. Ecological impacts of overwater structures include alteration of light, wave energy, sediment, and water conditions. These impacts may negatively affect the distribution, behavior, growth, and survival of fish, wildlife, and plants in the area around the structure. Another management issue will be to balance the allowance for new exempt docks with the newer standard of 'no net loss' of ecological functions.

6.2.10 Aquaculture

Aquaculture is the culture or farming of fish, shellfish, or other aquatic plants and animals, including breeding, hatching, rearing and acclimation, whether for research, restoration/enhancement, personal, or commercial purposes and may be located in-water, upland or both. Aquaculture is a water-dependent, preferred shoreline use of statewide interest. An aquatic farm is any facility or tract of land used for private, commercial culture of aquatic products. Each geographically separate facility or tract of land used for commercial culture shall constitute a separate farm site location. Existing aquaculture use/development include a fish hatchery and net pens.

Wahkiakum County has one net pen facility in lower Deep River (Reach: WFC_DeepRiver_07) and one net pen on the Town of Cathlamet's waterfront along the Columbia River (Reach: BakerBay_Columbia_15). The net pens in the Columbia River raise spring Chinook salmon on an annual basis October through February. The use of net pens should also be consistent with the Lower Columbia River Salmon Recovery Plan and ensure consistency with Endangered Species Act and other state and federal requirements so as to cause little or no impacts to wild fisheriesor shoreline ecological resources.. Net pens may present a use conflict with adjacent or nearby residential development, where homeowners are not favorable to the aesthetics and perceived environmental risks of such operations. As noted previously, some residents feel the net pens at the Town dock limit public access.

WDFW formerly operated a fish hatchery on the Elochoman River (Reach: EFC_BeaverCreek_02) that raised summer and winter steelhead as well as coastal cutthroat trout. The facility remains but has been closed since about 2008. Concentrations from the fish hatchery effluent and byproducts may have impacted water quality in the Elochoman River. Use conflicts could arise if/when the facility is reopened due to the trend for public access and parking at the unused site which could be limited or prohibited to ensure safe and effective operations.

6.2.11 Utilities and Transportation

Utilities

The location of essential public infrastructure such as public utility lines (i.e. gas and electric) near the shorelines could preclude the location of water-oriented use and development. Utilities infrastructure in the shoreline may also affect important ecological functions.

Wastewater
The only centralized wastewater systems, in Skamokawa and Cathlamet, have in the last ten years completed major repair and replacement on their wastewater treatment facilities. Additional proposed projects associated with these shoreline uses weren't discovered. New or expanded wastewater facilities may be necessary to address a waste-water demand from increased development as the Town and County grow. Additionally, the placement of any new waste water facilities on or near the shoreline may potentially displace other shoreline uses.

Water
Any future potable water needs in excess of existing water rights in the Skamokawa basin would need to consider relocation of wells or surface water intake so that it is within the zone of tidal influence, or prepare some sort of mitigation plan to offset the additional water right requested. It appears at present that this will not be necessary to meet projected population growth within the WRIA 25 planning horizon of year 2025. The Western Wahkiakum Water System, the Cathlamet Regional Water System and the Puget Island Water System are projected to have enough existing water rights and water capacity to meet projected demand through their respective WRIA 25 plan horizon.

Stormwater
As areas grow and develop, impervious surfaces (e.g. paved or gravel roads, building roof tops and parking lots) increase, which reduces the absorption of rain into the ground. This causes an increase in the volume of water and the rate of runoff, which can cause flooding and stream bank erosion. Stormwater runoff has been shown to be a significant source of water pollution in developing areas. Untreated stormwater washes pollutants such as sediment, oil grease & vehicle fluids, pesticides and fertilizers, salts, heavy minerals and other substances like pet and livestock waste from the surface of the land into nearby streams and groundwater. Low impact development (LID) is also called green stormwater infrastructure (GSI); techniques include rain gardens, bioretention swales, rainwater collection, permeable pavement, native vegetation landscaping, and green roofs. These can be designed and installed on individual residential properties or for larger neighborhoods/commercial areas and are effective ways to minimize stormwater impacts by mimicking natural processes. These methods are applicable for new development and for retrofitting existing properties/systems.

Transportation
Transportation facilities (roads and railways) have traditionally been placed within shoreline jurisdiction following topographically optimal routes. However, the introduction of these fixed and impervious structures has resulted in greater stormwater runoff, more shoreline armoring and, in many cases, a separation of shorelines from their associated uplands. Placement of transportation structures along shorelines has resulted in adverse effects to shoreline functions such as habitat and channel migration. The continued use of these transportation corridors and placement of new roadways is often in conflict with protecting and restoring riparian vegetation and natural shoreline functions.

6.2.12 Permit Exemptions and Cumulative Impacts

A number of uses and activities are designated by the SMA as being exempt from the requirement to obtain a Shoreline Substantial Development Permit (WAC 173-27-040) but nonetheless have direct or cumulative adverse impacts to shoreline ecological functions. For example, single-family residential use, while not water-oriented, is treated as a priority use under the SMA where appropriate and when developed without significant impact to ecological functions or displacement of water-dependent uses. Most single family homes and their bulkheads are exempt from the requirement to obtain a shoreline substantial development permit (SDP). It is important to note that all shoreline use and development must still meet the standards of the SMP even when a permit is not specifically required. This means that exemptions are only relieved of the SDP requirement but not exempt from the whole SMP. Many communities across the State that have also updated their SMPs have concluded that in order to meet the No Net Loss standard some types of exempt development in some locations are best managed as conditional uses with specific performance standards, allowing adequate project review to ensure SMP goals and policies are satisfied.

Cumulatively, residential development in shorelines increases impervious surfaces, clearing of riparian vegetation, and sources of pollution, and if unmitigated, contributes to an overall decline in shoreline functions. The cumulative effects of bulkheads are also known to result in major impacts to riverine habitat (WAC 173-26-231(ii)). Similar issues are related to docks and piers. These activities are not exempt from the requirement to be reviewed for consistency with the SMP as part of other permit processes (e.g., county building permit; Hydraulic Project Approval, etc.) and may require a different type of permit under the SMA.

Table 6.4 Table of Potential Use Conflicts/ Management Issues

	Conflicts and Issues
Agriculture	<u>Impacts to Natural Function</u> Riparian vegetation removal/ temperature Nutrient loading/ dissolved oxygen Erosion/ Sediment Water withdraw/ water quantity Bank armoring
Dams	<u>Impacts to Natural Function Downstream</u> Riparian vegetation removal Precludes natural hydrological cycles Reduces large woody debris recruitment Prevents fish passage Functionally divides ecosystem <u>Impacts to Inundation Area Upstream</u> All uses precluded in inundation area
Dredging and Dredge Disposal	<u>Impacts to Natural Function</u> Precludes or impacts restoration and natural functions Increase bank erosion. Accretion in lower stream reaches and associated flood impacts Toxic substances deposited or disturbed

Residential	Impacts to Natural function Riparian vegetation removal/ temperature Nutrient loading/ dissolved oxygen Erosion/ Sediment Heavy metals and hydrocarbons runoff Water withdraw/ water quantity Bank armoring and docks Increases flooding and flood vulnerabilities Docks/ hydrology, sediment transport, aquatic vegetation Impacts to Agriculture Competition for water quantity and quality Nuisance complaints and property taxes Impacts to Commercial/Industrial Nuisance complaints Prevents water-oriented use/dvlpt Impacts to Forest Practices – Mining Nuisance complaints Impacts to Shoreline Aesthetics Permanently alters shoreline character
Flood Management & Habitat Restoration	Effects on Natural Function Improvement to naturally meandering stream channels Improvement to off-channel habitats Improvement to production and deposition of large woody debris Improvement to riparian ecosystem functions. Impacts to Agriculture and Residential Potential inadvertent flooding from floodplain restoration
Forest Practices	Impacts to Natural Function Riparian vegetation damage/ temperature Erosion/ Sediment Watershed flashiness/ flooding, erosion, summer low flows Impervious surfaces Impacts to Public Access – Recreation Management for harvest precludes access/rec opportunities
Log Storage	Impacts to Natural Function Remnant piers or docks/ hydrology, sediment transport, aquatic vegetation Impervious surfaces
Outfalls	Impacts to Natural Function and Recreation Temperature, chemical, and biological pollution
Overwater Structures	Impacts to Natural Function Disrupts natural hydrological and sediment cycles

	Shades out aquatic vegetation Provides habitat to invasive fish, predators, and other aquatic species
Aquaculture	<u>Impacts to Natural Function</u> Nutrient loading/ dissolved oxygen May introduce parasites to hatchery and wild salmon Impacts to Shoreline Aesthetics Alters shoreline character
Utilities and Transportation	<u>Impacts to Natural Function</u> Surface and ground water withdraw reduces flows and increases temperature Stormwater delivers sediment, biological and chemical pollutants
Permit Exemptions and Cumulative Impacts	<u>Impacts</u> See impacts from “Overwater Structures”, “Residential” and “Agriculture.”

Chapter 7: Conclusions and Recommendations

Wahkiakum County's and the Town of Cathlamet's shoreline jurisdiction is characterized by the Lower Columbia River Estuary along with the major tributaries that flow through the County and empty into the Columbia River. The topography varies and includes large floodplain valleys, fairly steep hills and steep canyons in the upper reaches of the small tributaries, steep bluffs sections of the Columbia River and an island complex that contains developed, dredge disposal and naturally occurring islands. Water-oriented uses occur in the County's and the Town's jurisdictional shoreline. Some of the reaches have been heavily modified by a system of levees, pilings, armoring and other channelization instruments as well as areas with concentrated proliferations of overwater structures. Ecological processes such as sediment movement and water movement have changed within the County as a result of historic land uses including logging practices, levees, shoreline armoring, etc. However, development throughout the Town and County has been very slow to non-existent over the past decade. In addition, updated forestry rules have played an important part in reducing the impacts of new logging activities.

Each section above titled "Restoration Potential and Considerations" and "Key Management Issues and Opportunities" further identify areas for protection and restoration for each HUC 10 watershed and are summarized below.

7.1 Protect Ecological Functions

The Reach Matrix in APPENDIX A identifies specific areas that should be protected due to the existing ecosystem processes that are considered intact in each particular reach. Maps of the Important Areas (areas identified as contributing important ecological functions) and Impaired Areas (areas where natural processes are degraded) can be viewed in Chapters 4 and 5. The maps show areas that should be considered priorities for protection. Many of these areas, including parts of the Julia Butler Hansen National Wildlife Refuge, were identified as an Important Area and are already protected. Other areas that should be considered for protection are located across the County, but a permanent level of protection may be challenging given that many of the lands are privately held therefore the SMP must include provisions adequate for protecting shoreline functions to the 'no net loss' standard.

Additionally, standards for the Town and County Critical Areas Ordinance should be in line with state standards/recommendations, which are based on best available science. Critical areas located in the shoreline will be regulated solely by the updated SMP. However, much of the shoreline within the Town of Cathlamet has been developed and resulted in impacts to shoreline ecosystem functions. As a result the Town of Cathlamet, as well as other rural centers within the County, should focus on future development using lower impact designs and techniques where appropriate to avoid further degradation and impairments to ecosystem functions and processes.

Additionally, creative, legal use of Group B drinking water systems and small community wastewater management technologies could provide opportunities for more dense development in otherwise rural areas while continuing to protect groundwater sources and protecting ecological functions. Defaulting to minimum state standards in septic and water management, or zoning and shorelines regulation will not necessarily protect the communities' values or their finances.

As mentioned in Chapter 6, traditional forms of flood management such as levees conflict with natural functions, including channel meandering, off-channel habitats, production and deposition of large woody debris, and riparian ecosystem functions. The County currently has a moratorium on levee breaches, but levee breaching can play an important role in restoring floodplain and habitat functions. Wahkiakum County can use the Shoreline Master Program to create a framework for restoration and beneficial levee breaching projects that will be acceptable to local stakeholders without unnecessarily preventing the selective application of levee breeches.

Because forest practice activities must be consistent with SMP criteria, it is important to include regulations for protection of critical areas in the SMP updates, so that logging and land-conversion activities will have consistent protections of ecological functions within the SMA jurisdiction. By incorporating protection of critical areas into the SMP, more consistent criteria will be used within the SMA jurisdiction. There will still be potential conflicts outside the SMA jurisdiction that will affect the ecological functions of the shoreline. Until DNR FPAs are consistent with local government Critical Areas Ordinances, these conflicts and impacts will continue. Inherently, the Forest Practices Act and SMA could create potential conflicts between the demands of timber harvest and need for protection of all critical area functions including wetlands, marine bluffs, near shore forage fish habitat, as well as freshwater and marine riparian habitat protection.

Within shoreline jurisdiction there are many existing roads and utilities that often require repair and maintenance. In order to promote timely repair of these structures, the repairs and maintenance for transportation infrastructure and utilities typically meets the definition of the repair and maintenance exemption in the SMA and WAC. This level of review should be maintained as exempt activities in order to allow efficient and timely repairs to existing infrastructure. Exempt activities such as these would need to demonstrate that potential environmental damage has been minimized and/or can be mitigated for prior to the issuance of shoreline exemptions. This will ensure that these maintenance and repair projects are meeting the goals and intent of the updated shoreline master program. As defined under state law, exempt activity under repair and maintenance should be "construed narrowly" in that the repair or maintenance must only replace the existing use or facility within the same location, size and configuration. The Town and County could consider conditional use permitting for some activities in sensitive areas where more scrutiny is required to meet NNL.

7.2 Restore Degraded Habitat

Many Important Areas throughout the County have been impaired in some way, particularly in the lower reaches of the watersheds both in and out of shoreline jurisdiction. Floodplain areas often contain important areas such as wetlands that provide a variety of ecosystem functions, but have been impaired due to agriculture and other commercial, industrial, and residential development. These areas should be further evaluated for their restoration potential. Additionally, several areas throughout the County have been identified for potential restoration projects. Reach specific identification of restoration projects can be viewed in APPENDIX A. The Restoration Plan, a separate part of the SMP update process identifies and provides suggestions for the types of restoration projects in the Town and County to help maintain the No Net Loss standard of ecological functions/processes.

Almost all of the shoreline in the Town of Cathlamet along the Columbia River has been impaired by development and shoreline stabilization modifications. As a result, ???

Groups such as the Columbia Land Trust, Skamokawa Watershed Partnership, Wahkiakum Conservation District, Wahkiakum County Public Works and the USFWS have been working to implement projects to that improve salmon habitat, reconnect floodplains to tidally influenced reaches of streams, riparian planting, invasive species control and replace/upgrade culverts and other water control structures to improve hydrology and habitat conditions in areas that provide high ecological function.

Groups such as the Skamokawa Watershed Partnership have worked, using a collaborative approach between landowners and agency personnel, to implement projects that provide bank stability, instream habitat and hydrologic complexity, and riparian function improvements. This collaborative partnership has benefitted landowners while improving ecological function to the system as a whole and should serve as a model for other basins.

7.3 Improve Public Access

Several public access areas in Wahkiakum County and the Town of Cathlamet have been identified in the chapters above. They are also identified in the reach matrix in APPENDIX A. In addition, there are many informal access areas, particularly along SR 4 adjacent to the Columbia River and along some of the roads that parallel the Grays River. The difficulty in providing additional public access in the upper reaches of the SMA shorelines is due to the land being largely privately held. However several local parks exist along several of the main tributaries in Wahkiakum County that offer public shoreline access. The Julia Butler Hansen National Wildlife Refuge has two entrances off of SR 4 that lead to an access roads on both sides of a levee breach. Both roads into the NWR provide visual and physical shoreline access to the Columbia River. Opportunities to improve access would be to increase directional and educational signs, resting areas such as picnic tables for water-enjoyment recreation, and should be evaluated for the potential for public kayak or canoe launches into the Columbia River and/or Steamboat Slough.

Based on the SMP Community Visioning Process several public access priorities have echoed the priorities mentioned in the Draft County Comprehensive Plan (2008).

- Creation of walking, hiking and bicycle trails in the Skamokawa and Deep River subbasins.
- Addition of a boat ramp and moorage dock in Steamboat Slough and in the lower reaches of Skamokawa Creek.
- More signage and formal access areas along the Columbia River, particularly east of the Town of Cathlamet on SR 4 that address both safety to recreationalists and access for all.
- Creation of an additional park on Puget Island that offers transient moorage and camping and better facilities that are American Disabilities Act compliant.
- Conduct a general access study throughout the County to identify trails and fixed locations.

7.4 Support Water-Dependent Uses

Pursuant to WAC 173-26-020(39), "Water-dependent use" means a use or portion of the use which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operation. Uses in Wahkiakum County and the Town of Cathlamet considered to be Water-Dependent include:

- Aquaculture facilities (Net Pens and Fish Hatchery)
- Elochoman marina (Town of Cathlamet)

- Dredge disposal (various locations along the Columbia River)
- Navigation and flow lane maintenance
- Ferry terminal (Puget Island)
- Commercial Fishing
- Barge loading and unloading
- Piers, docks, and launches for public access, and WD recreation, commerce and industry

It is recommended that the County and Town continue to support these water-dependent uses through policy and regulatory safe-guards to uphold the SMA and WAC standards and to prevent pressures from non-water oriented uses. Additionally, future projects that involve water-dependent and other water-oriented uses or projects that are otherwise proposed near shorelines have been identified in Table 6.3 above.

7.5 Environmental Designations

The intent of establishing updated environmental designations is to encourage uses that will protect or enhance the current or desired character of a shoreline. Environment designations are analogous to zoning designations for areas under Shoreline Management Act jurisdiction and are meant to tailor use and development regulations to fit current conditions and to avoid a blanket approach to all shorelines

Recommended shoreline management priorities have been identified by reach and can be viewed in Appendix A. These measures along with existing and projected land use trends provide a context for developing environmental designations. Policies and regulations specific to environmental designations must be prepared. These policies and regulations will apply to all uses allowed within each environment designation. The Guidelines recommend a classification system with six basic shoreline environments:

•High Intensity
•Shoreline Residential
•Urban Conservancy
•Rural Conservancy
•Natural.
•Aquatic

Wahkiakum County and the Town of Cathlamet can establish a classification system different than that included in the Guidelines, or use their current environment designations. However, tailored environment designations must be consistent with the policies and purposes of the general environment designation provisions in the Guidelines and cover the breadth of the environments - as included in the Guidelines [WAC 173-26-211(4)(c)].

Based on the findings of the inventory and characterization work described herein, the proposed system of shoreline environment designations for the Town and County includes (see Maps 61- 67 Appendix E):

- High Intensity
- Medium Intensity
- Shoreline Residential – High Intensity

- Shoreline Residential – Medium Intensity
- Shoreline Residential – Low Intensity
- Rural Conservancy
- Natural
- Aquatic

7.6 Final Thoughts

This report and supporting analyses and documents provide the background and tools for ensuring that SMA shorelines are protected from degradation while providing opportunities for different types of reasonable and appropriate shoreline use, development and public access. The balance of these will ensure that the shoreline maintains the desired character that members of the community want. This report provides baseline data that will be drawn from to develop the policies and regulations in the SMP as well as required supplemental documents including the Restoration Plan and Cumulative Impacts Analysis.

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